THE IRON AGE

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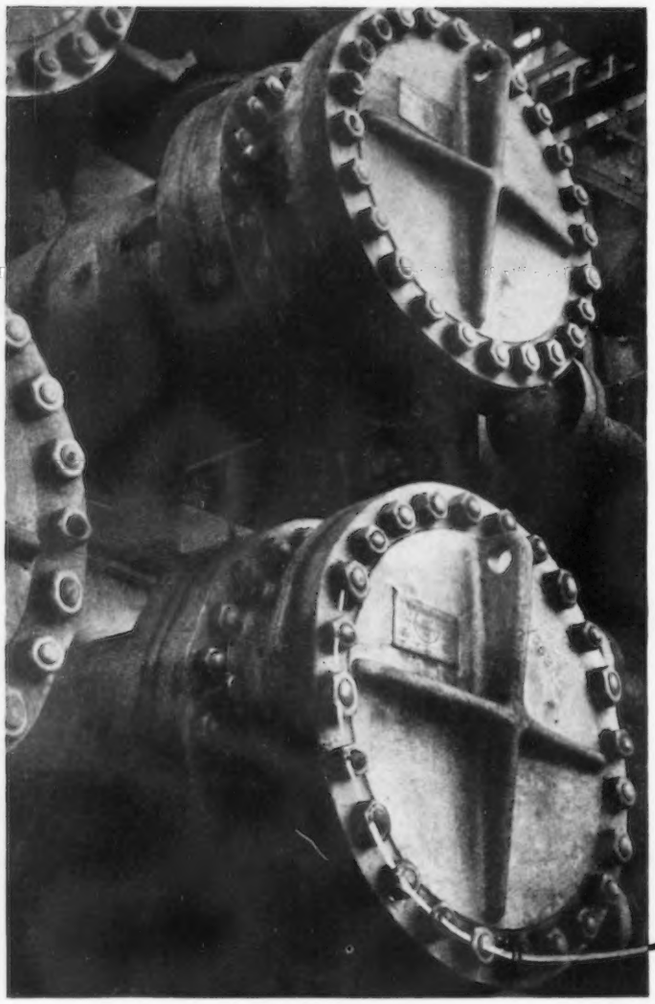

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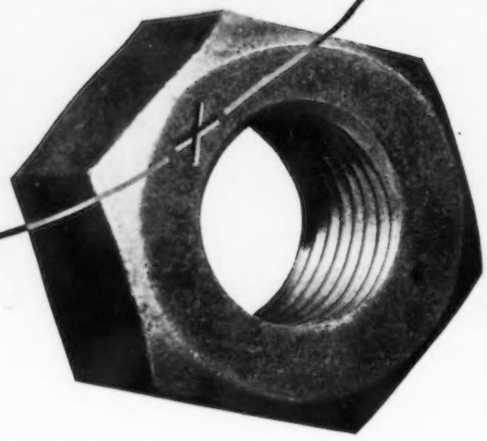

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We Must Not Default

THE general impression has been that we need not worry much about the passage of a 30-hour week bill, since the President and others in the Administration are believed to oppose it.

Over-confidence in this may be costly. There is no doubt but that industrial experts have fully advised the Administration of the damaging effects to public interest which would ensue from such a suicidal measure. The business press of our country has also been active in showing that an enactment of this sort would automatically lower our now depressed standards of living and penalize every consumer through an inescapable price rise of approximately 33 1/3 per cent.

But the fate of this proposal as well as of that of the new Wagner bill will ultimately rest in the hands of Congress, not of the Administration. And the American Federation of Labor, not finding comfort in administrative circles, has turned its big guns upon members of our national legislature.

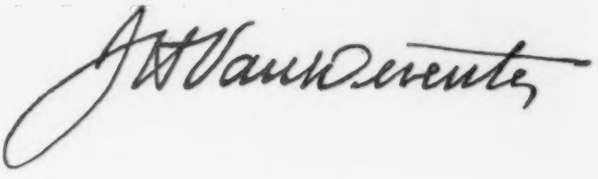
There is no surmise in this statement. The information comes directly from members of Congress, who state that while organized labor is now leaving no stone unturned to present to them the case for the 30-hour week, those who oppose it have given them little of convincing argument or evidence in rebuttal.

Congressmen are apparently somewhat case-hardened to the presentations made by organized business groups, although they seem to lend a sympathetic ear to the pleas of labor lobbyists. Or possibly it may be that industry is not "selling its goods" sufficiently far down the line. Be that as it may, in the case of the 30-hour week proposal, a most effective supplementary rebuttal would be through individual letters sent to Senators and Representatives.

Many who read this editorial are in position to explain, clearly and simply, just what a curtailment of working hours, with the maintenance of present weekly pay, as proposed, would do to their specific costs and therefore must do to their selling prices if they are to stay in business.

Evidence of this kind pointing to the effect upon consumers and based upon individual and specific cases, is much more convincing than any generalized presentation.

We suggest that if you are in position to assemble such facts, you do so at once and present them to your Senators and Representatives. We must leave no stone unturned, big or little, to prevent an economic catastrophe through default of individual effort.



Special Equipment for Reconditioning

BY M. M. McCALL

WHEN a locomotive driving wheel set is to be reconditioned, the tread and flange on both tires, the journals on the axle and the bearing surfaces on the crankpins must be turned, and in addition, the journals and crankpin bearing surfaces must be burnished. As it is considered advantageous to perform these operations without removing the wheels from the axle or the crankpins from the wheels, machine tools of special design are required.

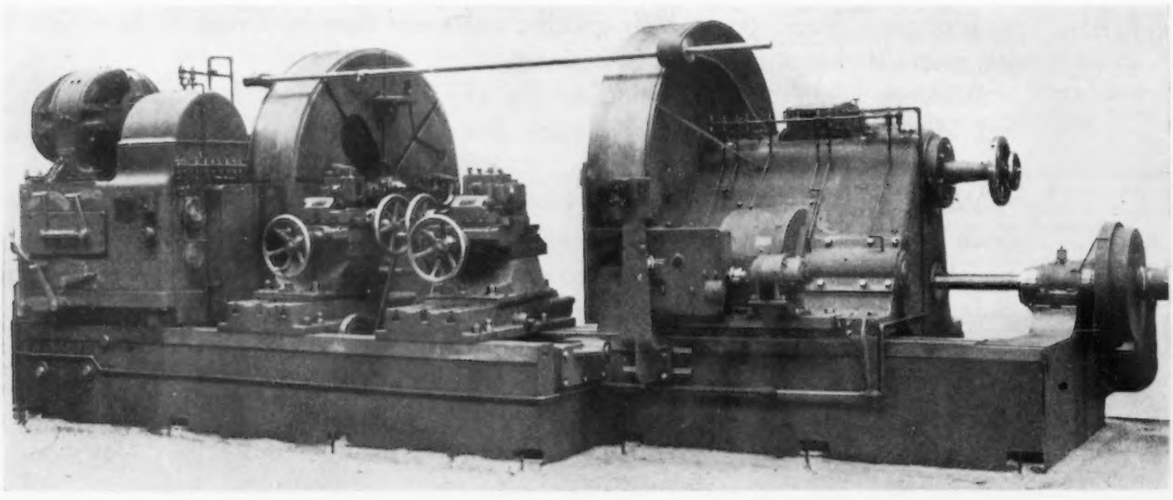
The treads and flanges are turned simultaneously on a driving wheel lathe similar to the 90-in. Niles machine shown in Fig. 1. The wheel set is mounted on centers in the headstock and tailstock spindles. The tailstock is provided with rapid power traverse along the bed by a 10-hp. motor. When positioned, the tailstock is clamped to the bed with powerful electric clamps.

Both headstock and tailstock faceplates are driven by a 50-hp. motor, the large internal gears on each being driven by compound gearing from pinions which are keyed to a heavy shaft in the bed. The wheel set is rotated by equalizing driver dogs fastened to each faceplate. A serrated face on each dog bites into the outside face of the tire, and by means of wedges, the biting action is increased as the cut becomes heavier. Cored openings in both faceplates for the crankpins permit the wheels to be located close to the faceplates. This shortens the height of the driver dogs and increases the rigidity of the drive.

Two tool rests are properly located for simultaneous turning operations on both wheels. Turrets are furnished in which the different tire turning tools are located. Feeds are provided from the driving mechanism by means of ratchet arms. A calipering device on the rod extending over the faceplates enables the operator to size both wheels to equal diameters. A push button to slow down the motor speed is useful when hard spots are encountered on tires which have been in service.

Fig. 2 shows a Niles 90-in. locomotive axle journal turning lathe. A wheel set without tires is shown for the purpose of illustration. The wheel set is mounted on centers in the headstock and tailstock

FIG. 1—Treads and flanges are turned simultaneously on this 90-in. driving wheel lathe.



Locomotive Driving Wheel Sets

and is rotated from the faceplate by clamps on one of the wheel spokes or by jaws clamping on the crankpin. In a cored space in the faceplate, an eccentrically located weight is radially adjustable by screws. This weight is set off-center to equalize the effect of the counterweights cast in the driving wheel centers. To aid in obtaining the correct position, an ammeter is connected in the line to the driving motor and placed on the headstock. A steady flow of current will indicate the proper location of the adjustable weight.

The faceplate is driven by belt on its circumference from a jackshaft in the rear. The jackshaft is driven by belt from a 15-hp. motor on the headstock. The drive arrangement may be seen in the rear view, Fig. 6. Two tool rests, mounted on a stand between the wheels, are provided with tools to simultaneously turn the two journals. Burnishing rollers are then placed in the tool holders to burnish the journals. Feeds are obtained from the drive mechanism. Cross feed is provided for facing the hubs of the wheels.

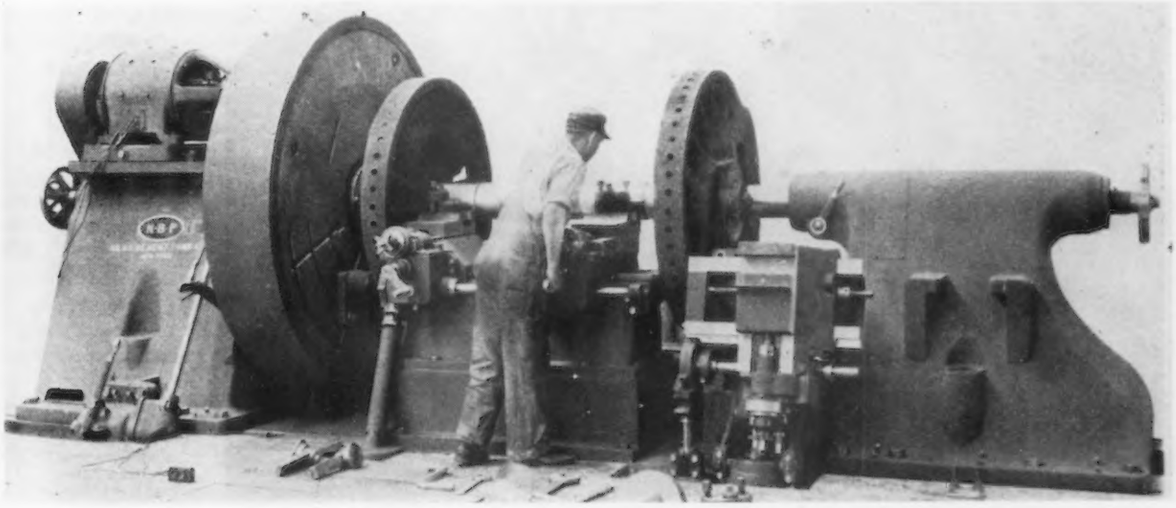
MACHINE tools designed to facilitate the reconditioning of locomotive driving wheels without removing the wheels from the axle or the crankpins from the wheels are described in this article. They include machines suitable for small as well as large shops, and equipment for wheel sets of three-cylinder locomotives, the design of which has complicated wheel set reconditioning.

Some locomotives are built with trailer wheels under the cab behind the drivers. The diameter of these wheels is usually larger than the largest car wheels, but smaller than the driving wheels. The machine is suitable for turning inside journals on these trailer sets, and is often furnished with an outside journal turning attachment, as some of the trailer sets have journals outside of the wheels. This attachment may be seen in Fig. 2. When not in use it is tilted off of its seat, as shown, by means of a piston in an air cylinder. When in use, it is necessary to turn the wheel set end for end in the lathe to machine both outside journals. Feed to the attachment is obtained from an extension of the regular feed shaft.

Both Crankpins Turned While Mounted in Wheels

Fig. 3 shows a Niles 90-in. quartering and crankpin turning ma-

FIG. 2—Turning journals on a 90-in. locomotive axle journal turning lathe.



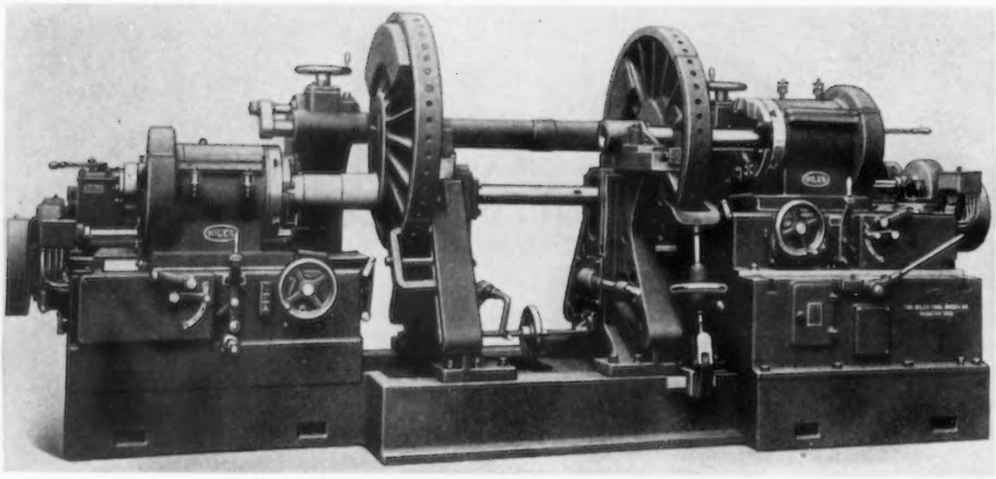


FIG. 3 — Crank pin turning operation on a left-hand wheel and boring operation on right-hand wheel. The machine is a 90-in. quartering and crankpin turning unit.

chine for simultaneously boring the crankpin holes in each wheel, or for turning the outside diameter of both crankpins while mounted in the wheels. As the radial center lines of the crankpins in each wheel make an angle of 90 deg. with each other, the machine is called a quartering machine. The crankpins may be positioned on the wheels in two different ways. If the pin on the right-hand wheel (either wheel being placed as the right-hand wheel) is 90 deg. in advance of the pin on the left-hand wheel as the wheels are rolled forward from the observer, the set is said to have right-hand lead. If the pin on the left-hand wheel leads, the set has left-hand lead. There are not many locomotives arranged for left-hand lead. While some of the older types of quartering machines were designed for operations on wheel sets with either lead, all the new machines have been built for wheel sets having right-hand lead.

The wheel sets are placed in the machine with each journal resting in a V-block. The V-blocks are adjusted vertically until the wheel set lines up with the centers of the machine. Rotating tool heads are mounted at both ends of the machine. The one on the left-hand end is located below the center of the machine and is adjustable in a vertical plane through the center to suit the eccentricity of the crankpin. The right-hand tool head is located in front of the center of the machine and is adjustable in a horizontal plane through the center. Each tool head is rotated by a 5-hp. motor and is provided with feed and power rapid traverse.

After the wheel set is centered, it is rotated until the crankpins line up with the tool heads. It is then securely clamped in position, and the pins are turned with two revolving tools mounted in tool holders on the tool heads. The tool heads have recesses which are deep enough to provide clearance for the longest crankpins. Burnishing rollers may be substituted for the cutting tools when the pins are to be burnished.

When new wheel centers are pressed on an axle, the holes for the crankpins are bored. Boring bars are inserted in the tool heads and are provided with inboard supports in the castings which support the V-blocks. These supports have adjustment in the same direction

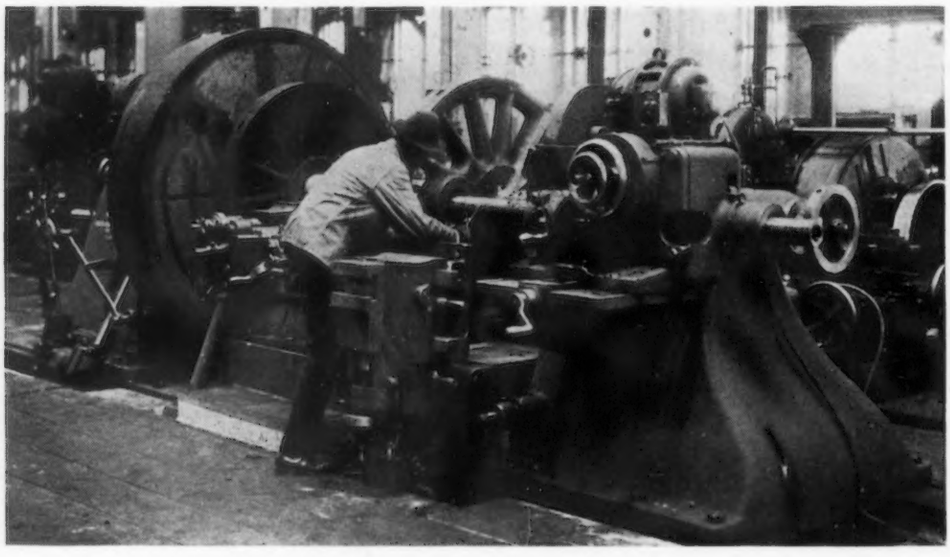


FIG. 4—Boring crankpin hole with quartering attachment on journal turning lathe.

as the tool heads. The left-hand end of the machine in Fig. 3 is arranged for pin turning and the right-hand end is arranged for boring. The boring bar for the left-hand tool head is temporarily placed in the center supports.

Machines Designed for Smaller Railroad Shops

In large railroad shops, all of the machines described can be kept busy. However, in the smaller shops with less work the problem is different. To provide suitable equipment for these shops, it has been necessary to build driving wheel lathes with journal turning and quartering attachments, and to design the journal turning lathe so that the additional operations of boring the crankpin holes and turning the pins can be performed.

Fig. 4 shows a 90-in. Niles journal turning lathe arranged for single quartering operations. The spindle mechanism with its 5-hp. motor and feed mechanism is mounted on a bracket on the front side of the tailstock. It is horizontally adjustable on the bracket to suit the eccentricity of the pin, the center of the spindle being in a horizontal plane through the center of the machine. A boring bar with an inboard support on the journal turning rest is used to bore the crankpin hole.

The same machine and attachment arranged for crankpin turning is illustrated in Fig. 5. A rotating tool head similar to the one used on the quartering machine is fastened to the spindle and its bearing is supported on a bracket mounted on a stand on the bed. When the machine is furnished with an outside journal turning attachment as shown, the attachment is swung out of the way by its air cylinder and the bracket is mounted on the base for the attachment.

When arranged for these operations, the journal lathe is provided with adjustable V-blocks and clamping provisions similar to those on the quartering machine. These features may be seen in Fig. 6.

When the journal turning lathe is arranged for single quartering operations, it is necessary to turn the wheel set end for end. An indicator suspended vertically below the headstock spindle is used to line up the hole or pin in the wheel next to the headstock and insure that the hole or pin in the other wheel is in the proper location to be quartered.

Lathe Equipped for Double Quartering and Pin Turning

The journal turning lathe shown in Fig. 6 is equipped for double quartering and crankpin turning. An additional quartering spindle with its 5-hp. motor and feed mechanism is mounted on vertical ways on the headstock under the main spindle. The quartering spindle is adjustable in the vertical plane through the center of the machine. During quartering operations, the quartering spindle passes through a clearance hole in the faceplate. An inboard spindle support is provided in the bracket which supports the V-block. The rotating tool head for turning the pins is held in a bearing which is supported by a bracket mounted on the bed in front of the faceplate, as may be seen in Fig. 6.

Obviously, when the machine is arranged for these operations both the headstock and tailstock must be adjustable along the bed. They are provided with rapid traverse from individual 5-hp. motors, and are clamped to the bed by powerful eccentric clamps. When set up for double crankpin turning, it is necessary to use extension centers, as shown in Fig. 6, to line up the wheel set.

The pads on the back side of the tailstock in Fig. 6 are provided for mounting the same bracket that supports the quartering mechanism on the front side. When mounted in this position, the quartering mechanism is turned end for end, but is suitable for boring and turning as the spindle extends from

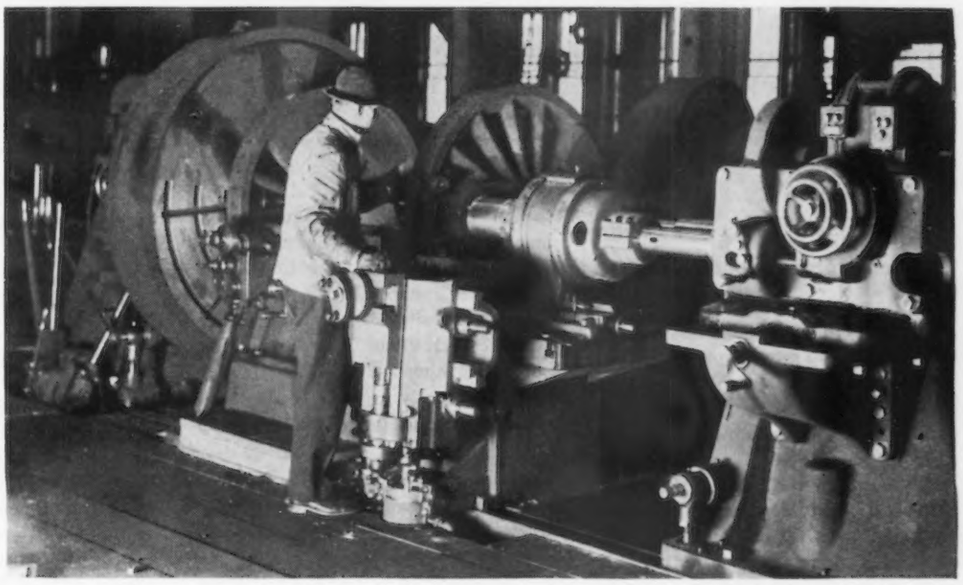


FIG. 5—Turning crankpin with quartering attachment on journal turning lathe.

FIG. 6—Rear view of journal turning lathe arranged for double quartering operations

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both ends of the attachment. This provision is made in case it should be necessary to quarter wheel sets with left hand lead.

Three-Cylinder Locomotive Design Complicates Reconditioning

During recent years a number of three-cylinder locomotives have been built. The design of these locomotives has complicated the reconditioning of the driving wheel sets. The crankpins on these sets are 120 deg. apart instead of 90 deg. A number of quartering machines of old design have been equipped with 30 deg. filler blocks on which one of the quartering mechanisms is mounted to increase the angle. No quartering machines of late design have been arranged for operations at 120 deg. Journal turning lathes have been built, however, with a 30 deg. filler block to be used with the quartering mechanism on the tailstock. Fig. 7 shows this block in position. The parts are accurately fitted and located with dowels so that either 90 deg. or 120 deg. operations may be performed. The inboard support for the boring bar is also provided with a 30 deg. block as shown in the illustration. Another 30 deg. block is necessary on the base to support the rotating tool head when turning the crankpin. The unit in the rear of Fig. 7 is the upper part of a portable Micro grinder mounted on the machine for grinding crankpins.

The third cylinder on the locomotive is central between the wheels, and its center line is inclined at an angle from the horizontal so that its driving rod will clear the axle of the front wheel set when it is attached to a central crank on the axle of the second wheel set.

To turn the journals on this crank axle it is necessary to remove the standard tool rests and their base, and substitute a low base with high tool rests to prevent interference with the sides of the central crank. One of these tool rests may be seen at the extreme left of Fig. 7.

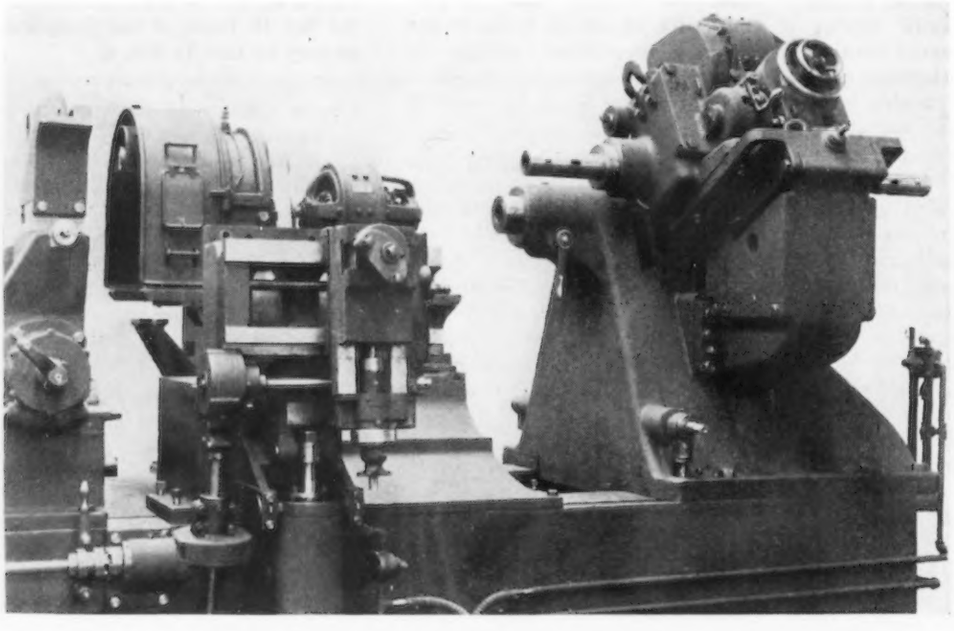

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FIG. 7—Journal turning lathe with quartering attachment mounted on 30-deg. filler block for "quartering" operation at 120 deg. on three-cylinder locomotive wheel sets.

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Late Returns from Laboratory and Mill

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By T. W. LIPPERT
The Iron Age, New York

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New Tungsten Carbide Tests 2000 Vickers

DURING the last decade scientists have constantly searched for hard and still harder materials. But for practical purposes hardness is not the only requisite. A metal must be tempered with some degree of ductility.

Various grades of tool steel first appeared on the market and were followed by even harder cemented carbides. Recently the Norton Co., Worcester, Mass., introduced its diamond-hard boron carbide. This material has many valuable applications as an abrasion resistor, but its usefulness in other lines is limited to some extent by its fragility.

Still another hard material is being developed in this country. The hardness of this tungsten carbide (not cemented) transcends that of cemented carbide, its ductility is exceedingly promising, and its reaction to experimentation has led to the belief that even further improvements can be made. The laboratory developing this newest cast tungsten carbide is having difficulty in securing a satisfactory grinding wheel for shaping it into desired forms.

Fig. 1 shows a test made on this new material by a disinterested laboratory. The impression is that of a diamond pyramid under 50 kg. load on a Vickers machine. This impression gave a hardness of 2000 Vickers, as compared with about 1300 for certain cemented carbides and 930 for hardened tool steel. It can be seen that the material cracked from the corners of the impression, indicating that it is somewhat brittle. However, it is not unduly brittle for its hardness, for a poorly nitrided case will crack in the same manner even with less hardness. The status of this material will be determined in the near future when additional tests are made to compare the characteristics of this and other similar products under actual service conditions.

Stainless Steel Has Low E.M.F. in Seawater

IF two dissimilar metals immersed in seawater are connected either by actual contact with each other

or a third conducting material, there is a flow of current from one metal to the other. This flow is accompanied by solution or corrosion of the negative metal. This corrosion, however, is not to be confused with any corrosion the metals might suffer *independently* as a result of seawater attack.

The possibility of serious corrosion arising from this cause in the case of widely differing metals used in aircraft, particularly marine aircraft, led to an investigation of potential differences by J. W. Willstrop (England).

The tendency of this electrolytic corrosion to occur is dependent on the e.m.f. or potential difference between the metals when immersed in seawater. In his experiments Mr. Willstrop used an invariable standard (normal calomel half-cell) against which each metal was tested, instead of attempting to measure the potential differences between various metals directly. The actual e.m.f. between any two metals is given by the difference of their respective potentials against the standard.

In all the metals tested the potenial was negative against the standard. Hence in comparing the potentials of any two metals, the metal giving the higher value of the two will be negative and *will tend to corrode* in the event of electrical contact while exposed to seawater. A few test results are as follows:

	Potential Against Standard (At 40 Deg. C.) Volt, Average
Austenitic stainless steel	0.20
Monel metal	0.18
Gun metal	0.21
Aluminum bronze	0.26
Brass	0.27
Duralumin	0.78
Cadmium (plating)	0.82
Aluminum	0.90
Zinc (plating)	1.13
Magnesium alloy	1.59

With some alloys, particularly stainless steels of the 18-8 type, a steady potential is not attained even after long immersion. Since the result seems to fluctuate, this might be accounted for by periodic changes in passivity. Duralumin samples take many hours to attain a steady potential. In the case of magnesium alloys the effect of contact with stainless steels is very marked. When these two metals are connected and immersed in seawater the magnesium alloy corrodes completely away in three days. When not connected the alloy suffers little change after six days. Inasmuch as stainless steel has a very low comparative potential, it rarely suffers from this type of corrosion. But in contact with other metals it may greatly accelerate their corrosion.

Oval Converter Has High Efficiency

EVER since Kelly developed the Bessemer converter in 1847, the form of this important steel-making unit has undergone many modifications. In this country the bodies of converters are often cylindrical in shape. Recent experiments in Germany, however, have shown that converters with an oval cross-section show a higher efficiency.

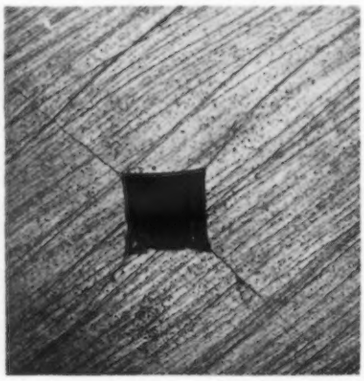


FIG. 1—This new cast tungsten carbide (not cemented) tests harder than certain grades of cemented carbides. This is a view at 100 diameters of a diamond pyramid impression in the new material. The diamond was slightly clipped, thereby causing the irregularity at one corner.

Thilo Heyden in a recent issue of *Stahl und Eisen* discusses an investigation on the wear of lining and the change of shape of two types of converters during a campaign. One converter was oval in cross-section and the other circular, as shown in Fig. 2. This same figure shows the progressive wear in the lining of the two converters. Consider the oval converter to the left. After 36 melts making 695 tons of metal, the lining was at position 1; after 63 more melts, at 2; after 73 more melts, at 3; and after 85 and 51 additional melts, at 4 and 5 respectively. At the beginning this converter had a volume of 810 cu. ft., and after the 308 melts the volume was 1620 cu. ft.

To the right in Fig. 2 are shown results of similar tests on the converter with a circular cross-section. After 43 melts making 733 tons, the wall was at 1; after 74 more melts at 2; and after 105 and 25 subsequent melts the wall was at 3 and 4 respectively. At the beginning this converter had a volume of 54 cu. ft., and after the 247 heats the volume was 1050 cu. ft.

As evidenced in the plan views, the wear of the linings was not uniform over the whole circumference; it was much greater on the back than on the belly, and this caused a displacement of the reaction space toward the back. It was also found that flow conditions were influenced in the same sense much more strongly in the oval than in the cylindrical form. During each campaign, graduated charges were blown in at the beginning and end of the life of each bottom in order to discover the connection between the charge weight, time of blowing and blast consumption on the one hand and the dimensions and shape of the interior of the converter on the other. A comparison of the results showed that the oval converter operated more satisfactorily. The observations also showed that the determination of the circulation cross-section must be based on the greatest surface of the reaction space.

In the article the author discusses the relationship between blowing time and the consumption of dolomite. Also reviewed are the relationship of the converter height to the conditions within it, and the mechanical processes taking place inside during the passage of the blast.

Slush Casting

A PROMINENT English maker of shoe lasts is now casting this product from aluminum in a unique manner. The same procedure is applicable to any thin-wall casting, using either aluminum or some other non-ferrous metal or alloy.

No core is required, the mold being constructed of two or more portions which can readily be opened and assembled into one piece. When closed the mold may be held together by some simple

clamp. The molten aluminum, or some other alloy or metal, is poured into the mold through an inlet until the mold is completely filled. The filled mold thereupon is immediately tilted or turned over to empty it through an outlet hole. Thus all the metal not solidified is removed from the mold, and the thin-skin casting produced by the chilling of the mold may be removed and subsequently trimmed and finished.

It is apparent that the temperature of the mold, rate of filling and time lag before emptying, all regulate to some extent the thickness of the casting. The inlet should be of sufficient size to enable the mold to be filled rapidly and easily, but is preferably of limited dimensions so as to prevent the flow back of metal collected in the riser leading from the outlet. The inlet and outlet both should be situated in the joint between the mold sections.

In case the metal does not flow out with sufficient rapidity, its exit can be hastened by introducing compressed air in the mold through a suitable inlet. This procedure is almost necessary when high-melting point metals are used. In complicated molds several such air passages can be used to obtain the desired wall thickness in various sections of the mold. Naturally the air passages leave apertures in the casting, but these points may be located in parts of the casting not required to be solid.

Uses Concrete Patterns

A LEADING English maker of bath tubs employs concrete blocks in preference to wooden patterns to obtain the sand impressions. An ordinary concrete block suffices for the purpose of taking the outside impression of the bath, but the block which has to act in the capacity of the core or inner side has to be specially made, inasmuch as it must withstand the effects of the molten iron, and not go out of shape for succeeding castings.

An iron box, not unlike a tub in shape, but open at the top and bottom, is lowered over the ordinary concrete block and sand is rammed in by hand. The top of the box represents the bottom of the tub. Pins are fitted to the bottom of the concrete block so that when the iron box is lowered on it the latter lies exactly in position and requires no further adjusting. The iron box with the sand impression of the outer dimensions of the tub is then raised by a crane and lowered onto the special concrete block, which has previously been coated with plumbago or black molding sand. Pins are also fitted in this block so the iron box fits it with accuracy. Although the pins cause the molds to lie in exact position, the depth to which the iron box is lowered can be varied at the discretion of the molder in order to make a thin or thick wall section.

The molding boxes are disconnected while the cast tub is still in a dull red-hot condition. The sand is emptied out and used over again for the next day's molding. The tubs are left standing in position on top of the inner block until the next day, after which they are inspected and weighed and subsequently dressed by means of a grinding wheel and sand blasting. Slight cracks are often welded together and the completed tubs are then enameled.

Non-Choking Hot-Blast Stove Checkers

A CHECKER design for use in blast furnace stoves must possess several important characteristics, namely, maximum exposed heating surface, gradual increases in deflection to prevent dust chokage, and a maintenance of velocity and turbulence effects in order to secure a maximum heat exchange.

The original Duoflex checker system apparently had all these qualities, but after long lengths of operation it was found that dust collected excessively at the top and middle zones. The original design had a top zone of straight brick, a middle zone of curved brick, and a bottom zone made of brick of still another curvature. Chokage was found at the junction of the straight and curved zone. In Fig. 3 there is shown a modified Duoflex design wherein all the zones are made of curved brick. It is believed that this will eliminate chokage.

This modified design should also

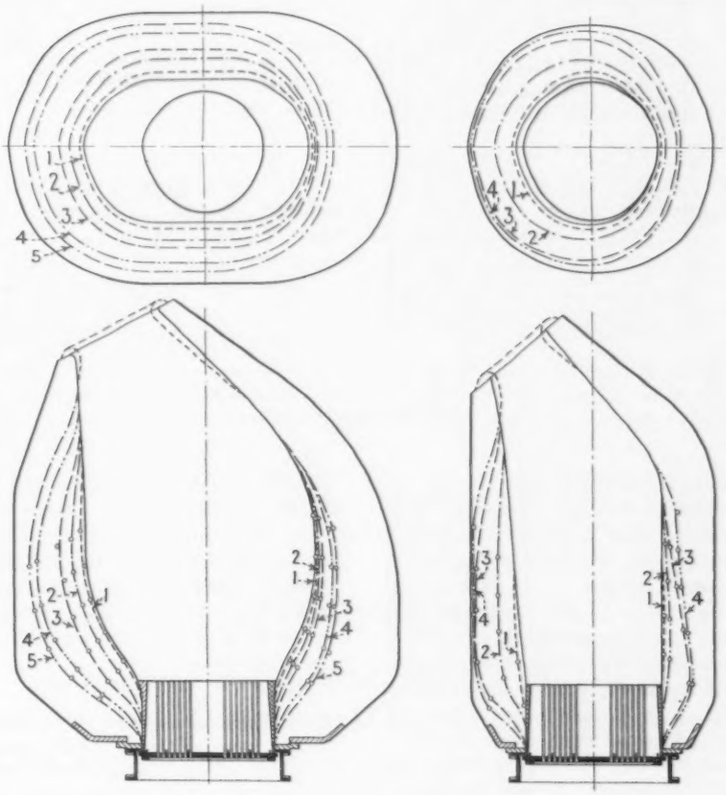


FIG. 2—Change in the shapes of two types of converters during a campaign. The converter on the left has an oval cross-section, and on the right is one of circular form. Both types are eccentric. The oval converter displays a higher efficiency.

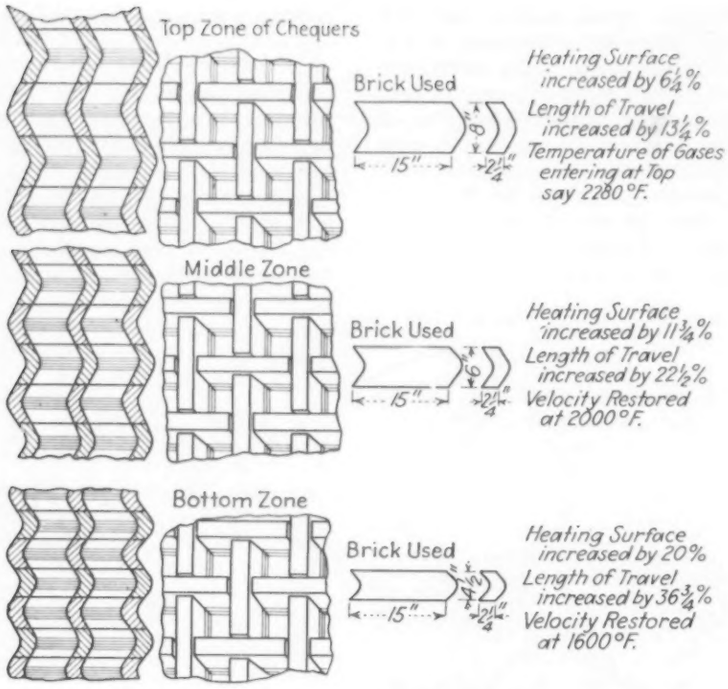


FIG. 3—Modified design of Duoflex checkers for blast furnace stoves. This design maintains velocity, and is of such construction as not to clog when handling dust laden gases.

increase the efficiency as well as eliminate dust collection. All four walls of each passage in each zone are curved, and the curvature is accentuated further in each of the lower zones. The cross-sectional area is progressively restricted in each zone, and there is a compensation for the decrease in velocity caused by reduction in volume of the gases as they transmit their heat to the checkers. Thus the original velocity is maintained in each zone, and the gases leave the bottom checkers at 1600 deg. F. at the same velocity as they entered the top at 2280 deg. F. The increased length of travel provided in this Duoflex system insures the same time interval for complete passage as would be obtained in a system using straight checkers throughout. This latter system would have decreasing velocities in the lower zones.

This checker system finds particular use in systems using partially cleaned gas which may contain 0.5 to 1.5 gm. of dust per cubic meter. It is claimed that a stove of this type constructed of brick 9 in. long to form passages 3½ by 3½ in. and exposing a surface of 150,000 sq. ft., will give an efficiency as high as another stove having 150,000 sq. ft. of surface, wherein the velocity is maintained by passing the gases quickly through the stove.

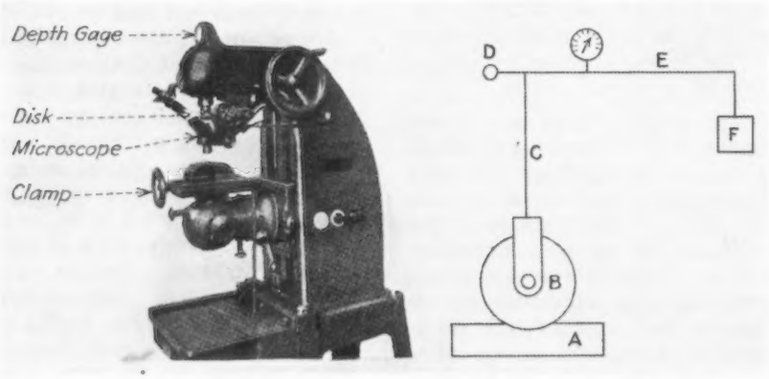


FIG. 4—English wear testing machine. The specimen is mounted in the universal clamp which is then moved up to press the material against a rotating Widia disk.

Wear Resistance Determined by New Machine

RESISTANCE to wear is a major factor in selecting suitable materials for machine parts, equipment, etc., and considerable effort has been expended to produce machines to measure this characteristic reliably. A new instrument of this kind is the Skoda-Sawin machine marketed in England, and illustrated in Fig. 4.

Metallic articles often do not resist wear in proportion to their strength or hardness, for hardness indicates durability against wear only if materials having the same composition and heat treatment are compared. If substantially different materials are in contact they should be individually tested to determine their relative ability to resist wear.

The Skoda-Sawin machine can make a test in five minutes with a sufficient measure of probability in units of volume of the impression in thousandths of a cu. mm., which has been attained after a specified number of revolutions (3000) of a Widia (cemented carbide) disk. The disk works at a specified load (23 lb.) and circumferential speed (675 r.p.m.). The impression caused by the disk does not damage the surface of the tested article.

Fig. 4 clearly shows the principle of the machine. The disk *B* is supported on two bearings connected by a yoke. The weight *F* acts on this yoke, through a lever *E*, which swivels around a fulcrum *D* and through a rod C, which slides in bushings. The lever is connected to a depth gage. A motor in the base of the machine turns the disk by means of a flexible shaft. The test piece *A* is cooled by a suitable stream of liquid (½ per cent potassium dichromate in distilled water), which also carries away the chips formed under the disk.

As shown in the photograph in Fig. 4, the test piece is clamped in a universal vise, and prior to the

test the specimen is brought accurately parallel with the periphery of the disk by means of a spirit level. After the test the gage determines the depth and a microscope can be swung over to measure the width of the impression. These values are used with an accompanying table to determine the wear resistance. The slightest change in the composition of the cooling liquid has considerable influence on the results. Therefore, the machine can be used on standard test blocks to determine the relative efficiencies of lubricating oils, emulsions and solutions used as cutting liquids. If tests of soft materials are to be carried out, the duration of the test can be shortened and the results converted to the normal number of revolutions of 3000, which has been fixed for the tests on hard surface pieces.

20-Ft. Rolls Brinell 450

RECENTLY a foundry received an order for hollow roller castings 20 ft. long. The outside diameter was 7 in., the inner hole measured 2½ in., and specifications called for a surface hardness of 450 Brinell.

The composition selected for this job had the elements necessary for successful hardening, namely low carbon and silicon, and sufficient alloy content to produce an initial hardening effect "as cast." The complete analysis was total carbon 2.90 to 3.20 per cent, silicon 1.30 to 1.50, nickel 1.75 to 2.25, and chromium 0.60 to 0.75 per cent. It was necessary to rough-machine the castings prior to heat treatment; therefore they were softened by heating to about 1300 deg. F. for 2 hr., which brought the hardness down to 200 BHN. It is possible to avoid this anneal by substituting approximately 0.30 per cent molybdenum for an equal amount of chromium, making the metal "as cast" slightly softer but not decreasing its ability to harden on heat treatment.

The heat treatment consisted of bringing the castings up to 1550 deg. F. in two steps; the first by warming them gradually to 950 deg. F., then speeding up the heating to 1550 deg. with a 1½-hr. soak at that temperature. The castings were quenched in oil and tempered in the range 450 to 650 deg. F. In some cases the hardness exceeded 450, but it was reduced to this figure by elevating the tempering temperature.

A New Non-Ferrous Alloy

TWO British air ministry specifications D.T.D. 232 (hard) and D.T.D. 237 (soft) have just been published for a new non-ferrous alloy of nickel, copper and zinc. This alloy was developed by William Gallimore & Sons, Ltd., Sheffield, England, and it is expected by them to have a great future for radiator tubes and other tubing on account of its strength and of the strong joints made when soldered.

For certain applications the alloy is likely to compete with stainless steel which it resembles, being white in color and readily polished. Extensive tests in seawater have shown that there is no corrosion in the metal itself or at the joints made with grade "A" tinman's solder. The physical properties of the alloy are comparable with those of materials having specifications D.T.D. 166-A and D.T.D. 171-A. It can be readily machined or cut. It will bend and take shapes with ease, although intermediate annealing may be necessary if such manipulation is complicated. The annealing temperature is about 780 deg. C., and the alloy can be quenched in water or air-cooled. Annealing does not cause scaling or have any effect on the surface except to dull the polish slightly.

This alloy can be soldered and welded with ease, strong joints being made with the usual grade "A" tinman's solder. The electrolytic action set up is negligible. It is not liable to fatigue or season cracking, and is one of those "neutral" alloys answering well in conjunction with the lighter alloys such as duralumin and the various steels.

Editor's Note: This is a series of observations which, strangely enough, are exactly what they purport to be. In other words, they come from the daily diary of a real boss; a prominent executive in the metal-working industry who prefers to remain an anonymous author.

The Boss's Diary

The Pharisees and the Publicans are still at it. I went to church last night and listened to a visiting clergyman make a very gracious and heart rending plea for better things.

After the service one of the Pharisees button-holed one of the young Publicans—one of the youngsters who does take a drop too much on occasion, who can skid disastrously now and then, but who can and does sing delightfully, who is trying to get his feet on solid ground, and proceeded to pan the singing and the service.

Result—discouraged Publican, sleepless night for Publican's anxious mother, disheartened minister, mad official of the church.

When, Oh when will the Pharisees of religion, of politics, of economics let us Publicans alone? I've an idea that in the humbleness of our "Lord be merciful to me, a sinner" we could go places if only the Pharisees would preen in their secluded grandeur and let us alone.

Boring Equipment Adapted for Automotive Pistons

PRECISION boring equipment arranged for the diamond turning of pistons with an elliptical and tapered skirt to a limit of 0.0005 in. on the major and minor diameters and on the taper; and a set-up for single-point finish boring of cylinders to unusually close limits are described in this article, which is from a paper on "Single Point Boring of Cylinders and Diamond Turning of Pistons," presented by Mr. Wise at the annual meeting of the Society of Automotive Engineers, held in Detroit, Jan. 14-18.

ONE of many problems confronting automotive engine manufacturers has been the production of pistons to the limits called for on their blueprints insofar as the elliptical and tapered form of the skirt is concerned. Grinding has been employed, but recently a precision horizontal boring machine (Figs. 1, 2 and 3) has been adapted for this work, and with this equipment it is possible to produce the necessary cam shape or ellipse shown in the accompanying drawing (Fig. 4) and at the same time to turn the taper on the skirt.

Fig. 1 shows a standard Ex-Cell-O Junior double-end precision boring machine equipped with suitable fixture for turning two pistons elliptical and tapered and turning two diameter ring lands in the same operation. On this machine the diamond turning of pistons is accomplished with a follower riding on a cam that has the desired form to be produced. This operation is similar to a pantographing operation. The elliptical tapered cam is mounted on the flange nose of the spindle and carries a rectangular driver, which fits and centralizes between the pin bosses of the piston. The piston is placed over the rectangular driver and a pilot locates in the open end of the bore.

The driver is designed to hold the pin bosses in proper relation to the cam shape, so that the elliptical form will always have its major diameter at right angles to the wristpin bosses. In the case of a split skirt piston, the driver carries two spring expanders for support-

FIG. 1—Precision boring machine arranged for turning two aluminum pistons in one operation.

Close Limit Machining of and Cylinders

By W. F. WISE
Ex-Cell-O Aircraft & Tool Corpn., Detroit

ing the skirt adjacent to the slot against the pressure of the cutting tool.

If the piston is located on centers, its dome end is supported by a tailstock having a live precision bearing center. If the piston is located on the bore at the open end and against the face of the open end of the skirt, then a spring clamped draw-bar is used for holding the piston with a pin through the pin bore. This draw-bar may be released while loading either by a hand-operated lever or a hydraulic cylinder actuated by pressure from the main hydraulic unit in the machine and controlled by hand or foot-operated valve.

Fixture Carries Turning Tools and Cam Follower

The fixture carrying the turning tools and cam follower is mounted on the machine table proper. It is provided with a hydraulically-operated cross-slide for moving the tools into the turning position at the start of the cycle and for a quick return from the piston at the end of the cutting stroke. Thus scratches of the tools dragging across the finished surface of the piston on the return stroke are eliminated. The diamond tools are in a position away from the work during the loading and unloading operations, thus eliminating the chance of accidentally damaging the turning tools.

The follower which engages with the cam, and the diamond tool for turning the skirt elliptical and taper are mounted on a member which oscillates about centers supported by the cross-slide and is backed up by a spring which provided the proper tension for the follower to contact the cam. The two tools for turning the ring lands are held in a rigid tool-block, which is also mounted on the cross-slide.

Ahead of the cam follower is a spring tension wiper for keeping the surface of the cam clean so that the follower will make proper contact throughout the entire length of the cam. Each of the three tools has individual micrometer adjustments for accurate setting.

FIG. 2—Single-end precision boring machine for turning two aluminum pistons without centers.

Coolant Delivered at Proper Point

In the turning operation it is essential that coolant be delivered at the proper point on the piston throughout the entire cut. Tubes with a series of holes are placed above each piston, which provides a complete flushing to the work and tools during the turning operation. The coolant carries the chips to the

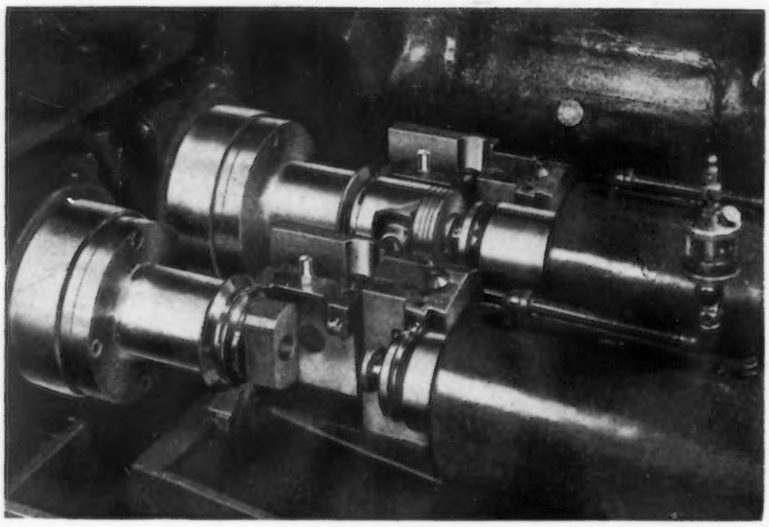


FIG. 3—Close-up view of the turning units and fixture, showing cam arrangement for turning the pistons.

fixture pan and then into a screened settling tank. A valve on the machine automatically shuts off the coolant at the end of the cutting cycle and turns it on just before starting the next cutting cycle.

The close-up view, Fig. 3, shows how two turning units are mounted on one bridge with the tailstocks mounted on the bridge at the opposite end. The turning units are heavy-duty flange-type Ex-Cell-O spindles with a single balanced driving motor mounted directly over them. The units and tailstocks are provided with a fine cross adjustment on each bridge for accurate alinement.

Each tailstock sleeve is a lapped fit in its bracket and is operated longitudinally by means of a rack and pinion through a horizontal bar in the bottom of the bracket. This bar has a vertical member which is connected to the end of the tailstock sleeve. As this member moves the tailstock sleeve forward, it is under spring tension for clamping the piston and provides a positive return of the sleeve. An adjusting and stop screw is provided in the vertical member so that the tailstock in the closed position exerts the proper tension on the dome of the piston. A standard jig lock operates the rack and pinion and holds the tailstock sleeve in the closed position.

One Operator Runs Two Machines

The production obtained per machine is 96 per hour, with one operator running two machines, loading the one machine while the other is turning.

The Ex-Cell-O precision boring machine used for this piston turning operation is standard in all respects except for the fixture and the cam arrangement on the front of each spindle nose. It is hydraulically operated and the movement of the table and fixture is operated from the main hydraulic system of the machine.

The accompanying sketch, Fig. 4, shows the ellipse and taper of the piston. Advantages of the diamond turning include better finish, which gives greatly increased bearing contact between piston and cylinder walls and thereby reduces initial wear. Turned pistons can be produced with greater accuracy, due to the lower tool pressure; and the greater uniformity as to size and

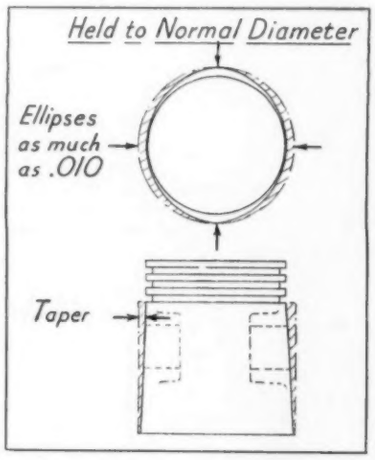


FIG. 4—Sketch showing how the ellipse and taper are turned on the aluminum pistons.

form is obtainable. Diameter limits can be held closer than by previous methods, it being possible to hold a 0.0005-in. limit on the major and minor diameters of the ellipse. A 0.0005-in. limit can also be held on the taper, and the edges of a full or T-slot are cut clean and not rounded off. Oil consumption of the engines and cold "slap" are reduced, the latter due to closer fitting; and time is saved in selective fitting to the respective cylinder bores, because of uniformity of piston sizes.

Single Point Boring of Cylinders

Another recent development of importance to engine builders is the single-point finish boring of cylinder blocks. In the past, most firms used a reamer before the honing operations. It has been found that during this reaming operation, if one or more flutes on the reamer become dull, or if the wall thicknesses vary, due to core shifting, there will be a tendency to produce a wavy or uneven hole in the finished cylinder block. Because these holes are not round and straight, most engine manufacturers leave a large amount of stock to be removed during the honing operations. In most cases, the hone follows these uneven or out-of-line holes, although they partially correct this unevenness. We believe we are safe in saying that it is almost impossible to correctly hone a hole as far as alinement is concerned unless this hole is round, straight and free from taper before the honing operation is performed.

With a machine for single-point boring the cylinder block, eight holes can be bored in one operation. A tolerance of 0.0003 in. for out of round and diameter of hole can be held with an alinement of a maximum of 0.001 in. for parallelism throughout its entire length with the center-line of the crankshift bore.

Uniformity of Iron Important

The machine illustrated in Fig. 5 is designed for boring four holes in each of two V-type cylinder blocks. The material in these blocks is a grade A cast iron (nickel iron) with a Brinell hardness of 180 to 240. A great deal of the success of this single-point tool cylinder boring operation is due to the iron, which if not uniform in structure and if harder than 240 Brinell cannot be machined without a great

deal of trouble to the limits required.

A feed of 0.007 in. per revolution is used on this machine, but feed is adjustable to meet individual requirements. Stock removed on the diameter ranges from 0.012 to 0.015 in. The difference between these limits makes no appreciable difference in the finish bored hole, and it allows more liberal limits for previous operations. The sizes of

any of the tools coming in contact with the finish bore of the cylinder as the spindles are withdrawn from the bored hole.

The fixture had to be longitudinally indexed for the next boring position, which represents the distance between the two cylinder bores. The blocks are loaded, clamped and unloaded automatically. The complete cycle is automatic.

As to the mechanical construc-

at the rear of the machine on the floor line. A "low pressure" hydraulic system is used.

Emergency hydraulically-operated valves are provided so that the slides can be reversed, or should any portion of the machine become jammed each slide can be automatically returned without causing damage.

This single-point precision cylinder boring machine bores to un-

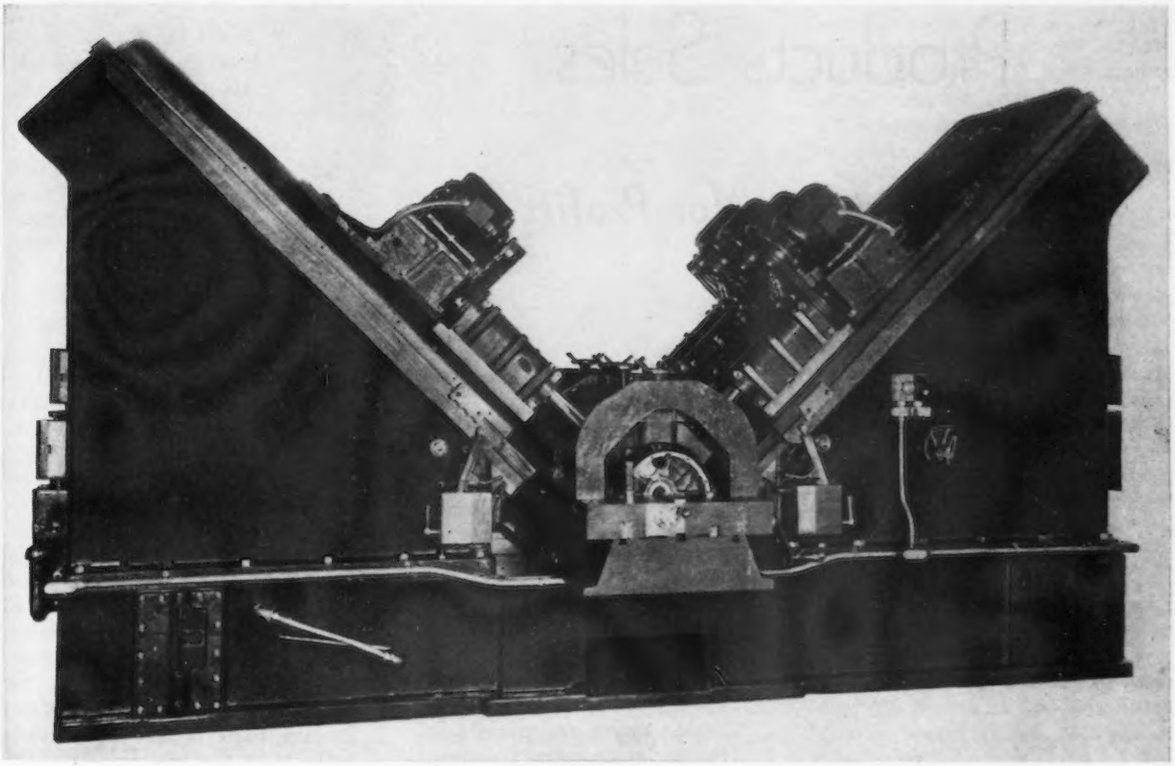


FIG. 5—Front view of eight-spindle, cylinder-block boring machine. o o o

individual holes are held within 0.0002 in. of each other.

In boring a 3 1/16 in. diameter hole, a spindle speed of 525 r.p.m. is employed. The single-point tools are tipped with tungsten carbide, and production of 30 eight-cylinder V-type blocks an hour is obtained.

Many difficulties had to be overcome in using a machine of this type for boring cylinders. All spindles had to be accurately alined in the bore and had to come to a stop at the end of the down-stroke of the slides. Accordingly the machine was designed so that a hydraulically operated mechanism brings all boring tools in alinement at the end of the boring stroke, so that when the fixture automatically oscillates back 1/32 in., there is no chance of

tion of the machine, the spindles and alining assembly rest on a slide having one V and one flat way, and are under full pressure lubrication. These slides are extremely long and are heavily ribbed to reduce to a minimum any vibration that may enter the machine.

Boring spindles are of the sleeve projection type, using four standard Ex-Cell-O precision bearings. They are driven by two V-belts with an individual motor for each spindle, thereby eliminating jack shafts and other mechanisms which might cause vibration. The spindle brackets, are bolted to the slide of the machine and have horizontal adjustment.

The motor used for driving the main hydraulic motor and pump is

usually close accuracy, only 0.0005 to 0.0007 in. being left in the bores for honing as against 0.002 to 0.004 in. generally left with the former method of reaming, etc. By leaving this small amount of stock, with a uniformly round and straight hole, naturally, the production limits on the finished product will be held to a more exacting tolerance, and at the same time eliminate the rough honing operation now done by most engine builders.

On the V type eight-cylinder block, alternate cylinders were bored, and it is our opinion that this plan or method will be used in the future for boring of cylinder blocks, because it gives the machine builder an opportunity to equip his machine with large, rugged spindles.

Attractive Finish Helps Metal Products Sales

32—Designing for Profits

o o o

By HERBERT R. SIMONDS

o o o

AN important feature of design of metal products is the nature of the finish and therefore a discussion of some principles of industrial design seems appropriate in this series on metal finishing.

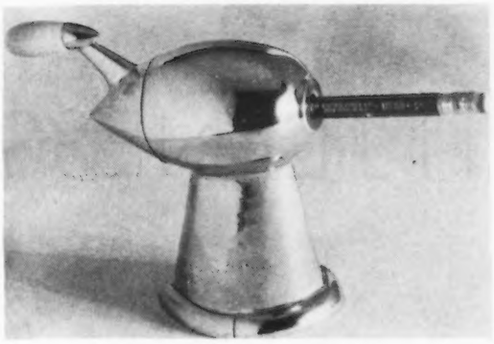
Whenever two products are otherwise equal, the one that looks more attractive to the purchaser will be bought first and when the demand is insufficient for both, the maker of the more attractive item may stay in business and the maker of the other go bankrupt.

The accompanying article describes some of the work of industrial designers and tells the small manufacturer how he can adopt a few of the principles of successful design in his own plant.

IN the metal working industry design may have as its primary objective reduction in cost or increase in sales and curiously enough these two factors often are unwittingly combined. If a designer attempts to better the appearance of a metal product, say a pencil sharpener, he generally turns to simplification, that is, to the use of fewer parts and fewer angles, and as a result of this the manufacturing cost of the article is frequently reduced and its maintenance simplified.

This most welcome state of affairs occurs most often when an article is being redesigned. In the original design the demand is uncertain and the manufacturer in his desire to risk as little as possible in tooling charges will often be led to put out a design which, while economical for the first few thousand parts, may be highly extravagant if the demand warrants mass production. A typical example of this sort of carry-over of original design to a point of extravagance is shown in the two illustrations of an old and a new pencil sharpener. The new sharpener designed by Raymond Loewy has many advantages other than improved appearance. It avoids collecting of dust, is more rugged, and on a mass production basis is less expensive to make than previous models selling in the same class. It is built of relatively few zinc die castings. The die casting is, in fact, a good medium for the redesigning of established parts. In hard zinc alloys it has sound structural value and readily takes most finishes. R. L. Davis of the New Jersey Zinc Co., who has devoted much attention to design of metal products, states:

"The subject of design usually includes finishing characteristics as well as form and contour. Nickel plating is one of the most common finishes and is found in three chief forms—bright nickel, brush nickel (Butler finish), and black nickel. An undercoat of nickel is a base for any of the usual metal plates, as, for instance, chromium brass, bronze, silver, platinum and gold. A rich bronze finish is used successfully by one manufacturer of sun lamps.



THE redesigned product—an example of a simple rugged item which lends itself readily to mass production.

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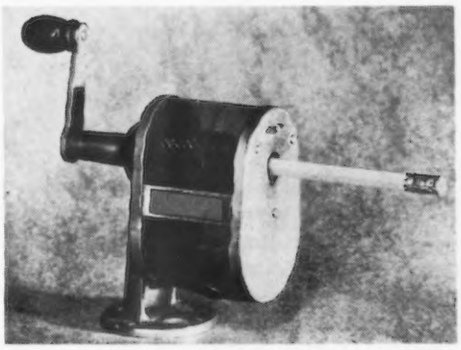
THIS early type of pencil sharpener was designed to keep the initial tooling costs low at a time when the demand was uncertain.



"Some unusual effects are secured on die cast parts by contrasting lacquer and plating. Zinc die castings when well made with polished dies have a smoother finish than many castings which are machined all over by any usual commercial process."

Someone has said whenever two products are equal in point of utility and price the one that looks most attractive to the purchaser will be bought first, and when the demand is sufficient to take but one, the maker of the more attractive item stays on in business and the maker of the other goes bankrupt. From this it is easy to realize the growing importance of industrial design and also the reason why the recent depression focused attention on this particular field of activity.

The foundation upon which the successful industrial designer must build his own career is a thorough knowledge of the properties of the material he has to work with. Such a knowledge in fact distinguishes the newer profession from that older one occupied essentially with decorative effects and well exemplified by artists employed by pottery manufacturers.

One of the first of those to turn to a study of raw materials was Donald Deskey in New York who credits much of his success in the design of metal furniture to a careful study of steel and other metals. A designer must know, he explains, that certain metals can be extruded and others not, that some are rigid and others pliable, that some rust and others resist corrosion. He must also know the standard forms in which the different metals are available, for the practical side in the design of a metal product must be kept in mind and standard shapes and sizes are generally cheaper.

In most metals and alloys the designer has sheets, bars, angles, wire and seamless tubes to work with. When he can use any of these he usually has an advantage in cost over other available kinds of material. However, in addition to these stock articles he may turn to castings, forgings, or die castings to solve his problems and while these forms have limitations they also have advantages which often are sufficient to indicate their use. In some cases where the quantity is great enough to warrant, the designer may originate his own form of material. That is, he may start the work of designing back at the source—at the rolls in the steel mill or at the dies in the extrusion machine. This is exactly what Mr. Deskey has done in one or two cases. He designed an aluminum bar which is simple to produce and yet which lends itself to a variety of applications. The cross section of this Deskey bar is determined from the space bounded by three equi-distant and slightly separated circles as shown in the accompanying sketch. A 30-in. piece of such a bar makes a decorative support for a small table. A shorter piece of the same bar makes a lamp, and a thin slice may become a book end.

The Designer and the Engineer

Next in importance for the successful designer to a thorough knowledge of materials is an understanding of the function of the article which he is to design. This is usually considered the particular province of the engineer whose field many industrial designers prefer not to invade. Nevertheless, it is obvious that a designer cannot create a new type of locomotive without knowing a great deal more about how a locomotive works. An excellent example of the close association of manufacturer and designer is found in much of the work of Norman Bel Geddes. A typical story of his work was told in a recent issue of *Fortune*. It seems that the Standard Gas Equipment Corpn. consulted him when they were about to bring out a new household stove. Their initial thought was for a decorative or artistic picture of a stove which

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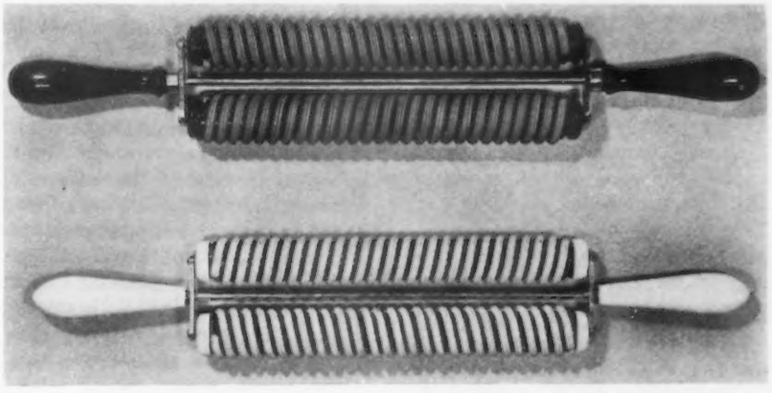

THESE contrasting colors in massage rollers well illustrate the value of appearance in design. The light colored roller redesigned by Raymond Loewy caused a sales increase of 120 per cent.

BRITTLENESS

° ° °

BY CARL L. SHAPIRO, Sc.D.

° ° °

LAST week the methods of testing steel brittleness at Harvard University were described. The many studies concerning blue brittleness were correlated, and a revised theory was given for the occurrence of this phenomenon.

Concerning secondary brittleness Freeman and Quick, in 1930, were the first to publish a paper dealing primarily with this subject. They were not the first investigators to observe the phenomenon, but were the first to emphasize the importance of it. The second and third papers on this subject were published by Quick.

Before going into detail regarding secondary brittleness it will be well here to discuss and define it. When steel is heated past its blue heat range the ductility increases steadily and should continue to do so with increasing temperature, but unfortunately this does not occur. It increases to approximately 200 to 300 deg. C. above the blue heat range, where it begins to decline very quickly to a minimum and then becomes ductile again with increasing temperature.

The temperature range in which the steel shows this decrease in ductility above the blue heat range and below the transformation range was called "The Range of Secondary Brittleness," by Freeman and Quick. They observed secondary brittleness in the following steels:[8]

Armco iron, annealed hypereutectoid steel (0.98C.), 0.30 carbon cast steel, chrome-molybdenum, manganese-molybdenum rail steel and medium manganese rail steel (1.2 to 1.7 Mn.). In the latter steel they stated that "the brittleness occurs at about 550 deg. C. and the elongation and reduction of area are appreciably lower than at room temperature (20 deg. C.), while the tensile strength at 500 deg. C. is about 50 per cent of the value of the normal temperature."

Quick summarized his results on 28 specimens of rail steels of 18 different heats as follows:[9] "The indications are that secondary brittleness is an inherent property in the steels used at present for rails, but that the ductility may be appreciably improved by slow cooling through the temperature range in which this phenomenon occurs." The materials used in this investigation were both carbon and medium manganese rail steel. The rails were tested in tension and showed a marked decrease in elongation and reduction in area between 400 and 700 deg. C., with the minimum values at 550 and 600 deg. C.

Quick's next paper dealt with the effect of the Charpy impact test on V notch specimens of medium manganese rail steel. The results of the impact tests showed that at a temperature of 500 and 600 deg. C. the energy absorbed was lower than that at either 400 or 700 deg. C. The fractures of these impact specimens were found to be transcrystalline throughout the range of temperature that the tests took place.[10]

Professor Sauveur wrote the following discussion on Freeman's and Quick's paper:[11]

"Subjecting steel to tensile stress above its elastic limit at a temperature of 500 deg. C. produces a certain amount of cold work, and recrystallization should take place if the temperature was high enough. In view of the relatively small amount of cold work produced, however, a temperature of 500 deg. C. is too low, and recrystallization does not take place. Stressing at 600 deg. C., however, is sufficient to cause recrystallization and we may assume that this phenomenon, while taking place temporarily, reduces the ductility of the steel. Stressing at 700 deg. C., or at a higher temperature, does not cause any work hardening, and therefore would not be accompanied by recrystallization and a temporary loss of ductility."

The above reasoning is substantiated by the following results obtained by torsion on some nonferrous metals by Jasiewicz.[12] The materials used were as pure as could be obtained.

Table 1 is presented to show the trend of secondary brittleness. The maximum brittleness, as denoted by the minimum angle of twist, in aluminum is at 300 deg. C., while in copper it is at 500 deg. Tables I and II summarize some of the results obtained in pure metals.

Taking the differences in temperature of secondary brittleness and the temperature of recrystallization, it is observed that this phenomenon occurs between 150 and 300 deg. C. above the recrystallization temperature and is present in any material that recrystallizes.

Secondary brittleness is affected by two factors: (1) heat treatment or grain size and (2) composition. These factors do not eliminate the brittleness but only tend to minimize or accentuate it.

TABLE I

These Data Show the Trend of Secondary Brittleness for Aluminum (99.62 Per Cent Al)

Temperature Deg. C.	Weight	Angle
20	10.9	4.20
100	8.9	4.00
200	7.3	3.53
300	5.5	2.73
400	2.4	6.22

[8] S. Freeman and G. W. Quick, A.I.M.E., 1930, pp. 225.
[9] G. W. Quick, Bureau of Standards Research Paper 408, 1932.
[10] G. W. Quick, Bureau of Standards Research Paper 409, 1932.
[11] A. Sauveur, Discussion, A.I.M.E., 1930, pp. 225.
[12] Jasiewicz, Harvard University Masters Thesis, 1930.

IN STEEL

Research Associate,
Harvard University

Heat treatment controls the grain size and will have the same effect. Fine grained materials seem to narrow and intensify the range of secondary brittleness while coarse grained aggregates widen and minimize this effect. This may be explained on the basis that fine crystals recrystallize much more readily than the larger material which spreads its recrystallization effect over a wider range of temperature and thus the loss of ductility is less marked.

The second factor affecting the secondary brittleness is the composition of the metal. Alloying elements, which raise or lower the melting point of the metal appear to affect the recrystallization temperature in the same way, as there seems to be a direct relationship between the recrystallization temperature and melting point. This relationship was established by Professor Sauveur. Given in the absolute scale this relationship is

$$\frac{\text{Melting Point (Abs.)}}{2.5} = \text{Recrystallization Temp. (Abs.)}$$

Since alloying elements affect the recrystallization temperature, they must also determine the range of secondary brittleness which depends upon the recrystallization temperature. Elements, which have a tendency to refine the grain size, sharpen and narrow the range of secondary brittleness. Elements which increase the grain size have the opposite effect, as they widen and dull the minimum range of brittleness. Elements, which raise the thermal critical point in iron and steel, particularly the A_3 point, raise the range of secondary brittleness and also narrow and sharpen it. They, as a general rule, refine the grain size. These elements are mostly of the body centered cubic lattice, with a few exceptions, and have high melting points, e.g. chromium, molybdenum, vanadium, and tungsten. The elements which lower the thermal critical range generally have a tendency to lower the range of secondary brittleness.

TABLE II

The Variation of Secondary Brittleness as Regards to Recrystallization Temperature

Metal	Recrystallization Temperature	Secondary Brittleness Temperature	Temperature Difference
Al	150	300	150
Cu	250	500	250
Ni	425	700	275
Fe	450	650	200

The works of Freeman and Quick illustrate the above effects, as they point out that secondary brittleness occurs at 550 deg. C. in medium manganese steels (Mn lowers the critical points), and in manganese-molybdenum steel it is at 600 deg. C. (Mo raises the critical points.)

Summarizing briefly; the range of secondary brittleness seems to exist in all types of metals and is caused by recrystallization. It is likely to exist from 150 to 300 deg. C. above the recrystallization temperature depending upon two factors, (1) composition and (2) grain size. The temperature at which secondary brittleness is located, depends upon the melting point of the metal, as that seems to determine the recrystallization temperature which in turn controls the temperature of secondary brittleness. Alloying elements which affect the melting point of the metal appear to affect the temperature of recrystallization and brittleness. The characteristics of the alloying elements are reflected in the range of secondary brittleness as they determine the temperature, width, and intensity of the secondary brittle range.

Secondary brittleness has been observed in various types of steel in this investigation, regardless of heat treatment. It has been noted in Swedish wrought iron, Armco iron, cast steels, carbon steels up to 1.58 per cent carbon, and in fact in every metal tested. This range of brittleness is more intense in the slower rates of testing, although this phenomenon is not a function of slow testing but is a physical property of the metal.

When iron or steel is worked at its transformation temperature a loss of ductility or an increase in strength is noted. This loss of ductility appears to be at a maximum at the lowest temperature at which allotropic transformation occurs. In order to designate this particular range of brittleness from other ranges it is called "transformation shortness" throughout the entire investigation.

Transformation shortness must not be identified too firmly with "red shortness," as red shortness seems to depend mainly upon the per cent of certain alloying elements, compounds, solid solutions or gases, while transformation shortness appears to be a physical property of iron and steel as they possess allotropism.

Red shortness or red short is the name applied to the brittleness or shortness of iron when it is worked at its red heat. Armco iron is intensely red short. It is readily worked from its solidification temperature to 1000 deg. C. But on working from this temperature to 900 deg. C. the metal becomes brittle and is easily shattered. Working from 900 deg. C. to room temperature has no ill effects on the material, and in order to eliminate this type of brittleness the material is worked only above and be-

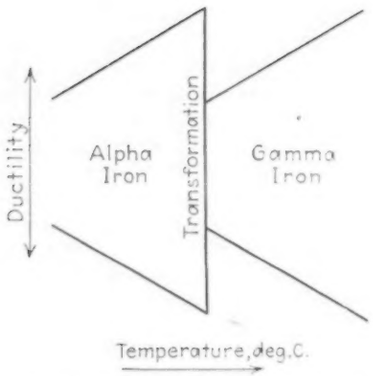

FIG. 10—Professor Sauveur's portrayal of transformation shortness. As the temperature of test is raised, the minimum ductility at the instant of formation of the newly created gamma iron gradually increases and finally surpasses the ductility of the very ductile alpha iron.

low this range of temperature. The metal is allowed to cool through this temperature range without any deformation being applied.

There have been many reasons advanced to account for red shortness, but the only two which seem to be worthy of discussion are the oxygen and sulphur theories. The basis of the first theory is that as soon as sufficient manganese is added to the red short material the red shortness disappears. This disappearance is claimed to be due to the fact that manganese has a great affinity for oxygen and deoxidizes the solid solution of oxygen in iron. Since this deoxidation removes the cause of red shortness (oxygen in solution), the material naturally becomes normal.

The foundation of the sulphur theory is laid on the basis that iron and sulphur or iron sulphide forms a eutectic at a temperature within the red short range. This eutectic of iron and sulphur forms around the grain boundaries when the metal is cooled through its solidification temperature, and when it is heated or cooled through its eutectic temperature it melts and thereby causes less cohesion between the grain boundaries. If the metal is allowed to solidify without working, the cohesion is reestablished and the metal is in a normal working condition. But if the metal is worked during this period of lost cohesion, then the material is fragile and is readily shattered, or is "red short."

The experimental results do not appear to be in concordance with the above theory, as the latest equilibrium diagram shows that the eutectic temperature of iron-iron sulphide is at 985 deg. C., while the maximum red short range in Armco iron is located at approximately 925 deg. C. From this, it seems that the theory does not comply with the experimental data as the brittle range appears much lower than the theory allows. Additional criticism against the above theory may be taken from the fact that the intensity of the red short range may be markedly reduced if the oxygen content of the iron is less than 0.01 per cent, while the sulphur content remains practically constant.

A modified version of the first theory of red shortness is now advanced. Red shortness in iron may be affected by two factors, first, oxygen in solution, and second, transformation shortness. The first factor may be the direct cause of shortness in relatively pure iron and very low carbon steels, but it may be intensified to a slight extent by the loss of ductility caused by transformation. While in high carbon steels, where there is no red short range, the second factor predominates and causes brittleness.

Doctors van Wert and Rogers have shown that when Armco iron and other materials are heated through their transformation range, transition occurs by means of a wave effect which starts at one point and sweeps across the entire surface.[12] The formation of a new crystalline phase (gamma iron) creates slip resistance. This slip resistance may be partly due to the formation of the new crystalline phase, and partly to the new crystalline orientation of the grains and boundaries. As the temperature of test is raised, the minimum ductility at the instant of formation of the newly created gamma iron gradually increases and finally surpasses the ductility

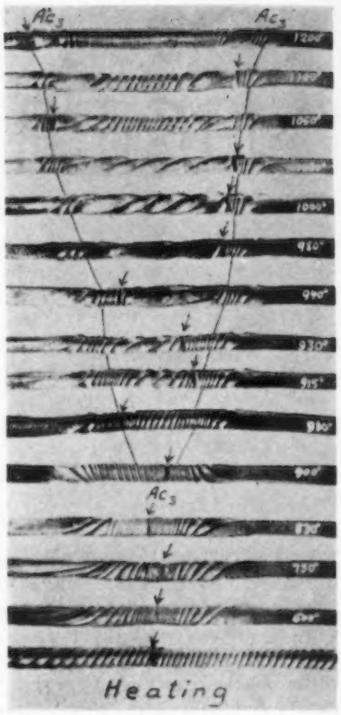

FIG. 11—Professor Sauveur's demonstration of transformation ranges and temperatures. These bars were heated in the middle and then twisted. The minimum angle of twist occurs at the transition temperature.

TABLE III

Variation of Breaking Weight (Pearlitic Steels) With Carbon Content

Temperature Deg. C.	0.12 C.	0.38 C.	0.82 C.	0.88 C.	1.02 C.	1.17 C.	1.23 C.
—180	59.7	70.0	76.1	...	84.2	77.2	82.5
—78	37.4	48.3	55.2	...	60.6	57.8	58.7
25	32.2	43.6	47.7	50.4	54.0	50.5	48.0
100	29.4	38.0	38.6	46.5	49.0	46.5	46.0
200	31.4	38.0	39.6	46.9	47.7	44.5	41.6
275	32.2	41.6	49.6	50.7	49.4	46.9	48.1
300	31.6	42.9	49.7	53.1	51.1	50.0	49.1
325	29.2	42.5	53.2	...	53.5	...	45.6
400	30.0	34.5	51.5	53.8	51.1	54.2	44.4
500	21.1	28.4	27.8	30.2	31.4	33.7	26.8
600	10.8	16.1	14.4	16.6	20.2	14.7	18.3
650	6.6	10.7	10.7	12.0	14.0	11.5	12.0
700	4.9	7.4	10.0	9.4	10.4	7.4	7.7
750	3.4	5.2	6.8	6.8	7.7	7.0	7.2
800	2.9	4.9	...	3.6	6.1	5.8	6.0
900	3.0	2.9	3.1	2.5	3.2	3.0	3.1
1000	2.2	2.2	...	1.1	2.1	2.1	3.1

[12] L. R. van Wert and B. Rogers, A.I.M.E., 1931.

of the very ductile alpha iron. This is illustrated in Fig. 10.

Transformation ranges and temperatures were determined in 1922 by Professor Sauveur when he observed that the minimum angle of twist was recorded at the transition temperature, while above and below this range the ductility increases.[14] This is shown in Fig. 11, and is summarized by Professor Sauveur in the first Howe Memorial Lecture, "What Is Steel?"

"Twisting and tensile stresses applied to iron and steel bars heated at the middle to predetermined temperatures, the temperature falling gradually towards both ends of the bars, give the following results:

"(1) In iron and steel exhibiting an independent A_3 point, hence in iron and in steel containing less than 0.40 per cent carbon, when the bars are heated in the middle to temperatures inferior to that point, they undergo twisting or contraction and finally rupture near the center where the temperature was maximum. When bars are heated above that range they again twist or contract and rupture at the center where the temperature is maximum."

Professor Sauveur[15] again gave added impetus to transformation shortness in 1930 when he stated "that red shortness in iron and steel when it exists is most intense slightly above the A_3 point when gamma iron is about to transform on cooling, or when it has just come into existence on heating. It is believed that alpha iron is never red short. To put it another way, red shortness appears to be a property of face-centered (gamma) iron and to be at its maximum intensity at the lowest temperature at which gamma iron can exist. These remarks, of course, apply only to carbon steels."

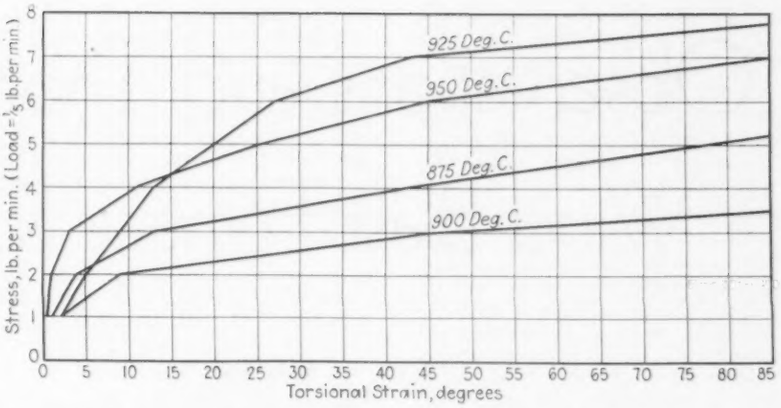

FIG. 12—Stress-strain diagram of annealed Armco iron worked by torsion at the various temperatures indicated. These data show the loss of ductility when the iron is heated through its red short range. The ductility is a maximum at 900 deg. C.

The above facts are further illustrated by the stress-strain diagram of Fig. 12 which shows the loss of ductility when Armco iron is heated through its red short range. After passing the range of secondary brittleness the ductility continually increases until it reaches its maximum at 900 deg. C. Further working or twisting at 925 deg. C. causes a decreased ductility as transformation creates the gamma lattice to impede the progress of the rupturing alpha iron, since the alpha iron does not transform all at once to gamma but transforms progressively. Theoretically, the steel is in a heterogeneous condition at the first stage of transformation, as it contains alpha iron (untransformed) and some gamma iron (transformed). The new structure interferes with the slip of the alpha grains, and while this slip is gradually being overcome other deformed alpha iron transforms and reinforces the ever weakening gamma iron. This continues throughout the test until all the alpha iron transforms. When the temperature is raised to 950 deg. C. the transformation of alpha to gamma occurs much quicker and causes a greater resistance to slip at first, but it is very quickly overcome and the metal becomes ductile as the gamma iron's plasticity is increased. (See Fig. 12.)

As soon as any element that affects the allotropic point (A_3) is added, the same influence is immediately noted in the range of transformation shortness. The allotropic range in iron and steel can be raised or lowered, narrowed and sharpened, or widened and dulled by the addition of proper alloying elements. The characteristics of the transformation range depend upon the amount and physical properties of the alloying elements.

If an element that causes a sluggish transformation is added to iron then the allotropic range will seem to disappear in quick testing, but in relatively slow testing it will reappear. The most notorious of these sluggish elements is manganese. It widens, lowers, and dulls the transformation range so

[CONTINUED ON PAGE 73]

[14] A. Sauveur, A.I.M.E., 1924.
[15] A. Sauveur, A.S.S.T., 1930, pp. 432.

TABLE IV

Variation of Angle of Twist (Pearlitic Steels) With Carbon Content

Temperature Deg. C.	0.12 C.	0.38 C.	0.82 C.	0.88 C.	1.02 C.	1.17 C.	1.23 C.
—180	0.683	0.287	0.092	...	0.154	0.229	0.123
—78	1.05	0.458	0.222	...	0.200	0.389	0.213
25	1.37	0.60	0.240	0.312	0.184	0.255	0.208
100	1.60	0.60	0.311	0.303	0.181	0.313	0.370
200	0.87	0.42	0.256	0.235	0.193	0.255	0.411
275	0.85	0.39	0.133	0.120	0.189	0.215	0.147
300	0.83	0.21	0.139	0.153	0.180	0.220	0.194
325	0.78	0.256	0.147	...	0.175	...	0.403
400	0.93	0.625	0.545	0.70	0.569	0.514	0.694
500	2.26	2.20	1.95	1.83	0.500	0.600	0.81
600	7.75	2.70	2.10	1.725	0.516	1.16	0.50
650	12.90	5.25	2.13	0.97	0.556	0.85	0.90
700	13.00	6.00	2.56	1.75	0.536	1.75	1.19
750	7.75	6.60	1.65	4.25	0.578	0.75	0.528
800	3.50	8.13	...	27.75	3.07	3.27	1.95
900	11.00	10.00	5.00	63.00	29.50	4.28	2.85
1000	8.00	11.25	...	70.00	33.75	12.00	34.00

Observations and Theory on Slack Wind Blast Furnace Operation*

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PRIOR to the start of the world-wide depression, the primary objective of most blast furnace operators was to produce a maximum tonnage of pig iron per day for each furnace in blast. Some attention was paid to the conservation of labor and raw materials, but the idea was well established that low-cost pig iron was attainable only when each furnace was producing a high tonnage.

But during the depression the picture changed considerably. Each blast furnace operator was forced to run his plant in a manner that best fitted the economic set-up of his company. Because of the economic factors involved, the furnace superintendent was compelled to indulge in various practices, many of which were believed to be next to impossible up to that time. The ultimate purpose of these innovations was either one or a combination of the following:

(1) To produce only enough pig iron for immediate consumption at a minimum cost.

(2) To produce gas for boiler or mill use to supplant some higher price fuel.

(3) To consume the coke produced at the coke plant, which was often viewed as a by-product.

(4) To protect the cash position of the company.

THE blast furnace operators met the conditions enumerated above by diverse methods, some of which were (1) slow or decreased wind, where in some cases the blast blown was held as low as 25 per cent of the normal volume, (2) intermittent operation, when the furnaces were shut down or "fanned" at frequent intervals, and (3) slow wind for a week or so and then normal wind for a short period; each substantial change of wind was often accompanied by a change of burden in order to produce a different grade of iron.

It is needless to say that in spite of these methods, the depression conditions necessitated the production of iron of excellent quality to meet the keen competition of other companies and the rigid specifications of customers.

It is the opinion of the writer that slow wind operation has done more toward perfecting blast furnace technique than has any other development. Many furnace men have found that lowering the wind on their furnaces meant a decrease in fuel consumption and flue dust losses, in spite of the fact that there were many "sick" furnaces before the fundamentals of success for slow blowing were appreciated. An inspection of these fundamentals reveals nothing new to the blast furnace operator, but one important fact is that *any infraction of these rules is accompanied by far more serious results on slow wind than when on normal wind.* These principles have been proved many times in practice and are tabulated below:

(1) The furnace lining must be in fairly good shape. The brick work should not be cut out or built up excessively and the furnace must be operated in such a manner that the walls are kept clean at all times. The lining should be plumb, the ideal condition being that the traces of all horizontal planes with the inwall shall be perfect circles, the loci of whose centers shall form a straight vertical line which is the true center line of the furnace.

(2) The top-charging mechanism must be correctly designed, located, and operated. The vertical center lines of both bells and their respective hoppers should be colinear with the true center line of the furnace in all positions. Both bells and their hoppers must be kept clean at all times. The distributer must be working correctly, and the entire charging equipment operating so that equal portions of each raw material are deposited in all sectors of the same size in the furnace.

(3) The correct filling must be used. By this is meant that there are always a few methods of filling, with regard to the sequence and quantity of each raw material charged, that give the best results on the furnace under the operating conditions at a certain time.

(4) Each raw material should be as nearly uniform in chemical analysis and physical properties as possible. Also, each material should be weighed and measured correctly at all times according to the schedule determined by the operator.

(5) Enough slag volume should be carried to run the furnace on a lean or glassy slag, if the raw materials and the sulphur content limits of the product will permit. Some plants are also limited in this matter because the slag is used for commercial purposes and must successfully meet the tests of the customers. It is the general opinion that more slag volume is required as the wind is decreased.

(6) The blast distribution must be uniform in temperature and

*Abstract of paper presented before the annual meeting of the American Institute of Mining and Metallurgical Engineers in New York, Feb. 18.

quantity at each tuyere or at least at each pair of adjacent tuyeres.

(7) The correct size of tuyeres must be used in order to meet the operating conditions.

Should Check Furnace Lining

The writer believes that the best way to keep an accurate check on a furnace lining is to install thermocouples in the lining, preferably at the start of the campaign. The hot junctions should be about 12 in. from the original inwall and the cold junctions connected to a multiple point recorder. This arrangement has proved very satisfactory in several plants. Another method is to determine the heat absorbed from the cooling water while passing through the plates located above the mantle. If this method is used, the plates should be blown out before testing so that there will be no dirt left which would tend to insulate the copper. If both of these procedures are used on the same furnace, they usually will be found to check quite closely.

If there is doubt in the operator's mind whether the furnace is cut out on the hot side or built up on the cold portion, test holes can easily be drilled to check the lining. If the lining is badly cut on one side, the true center of the furnace is moved in that direction. The practice on the furnace will be improved if the charging apparatus be moved so that its center coincides with the new center of the lining. A great deal of checking should be done to determine the cause of the excessive wear, otherwise, if allowed to continue, a hot spot is apt to develop which may necessitate blowing out the furnace and patching the lining.

If the lining is built up, which the writer believes is more apt to happen on very slow wind, the usual remedy is to upset the filling in an attempt to clean off the "scabs." One furnace man in the Chicago district has reported his experience. His particular furnace had been working very poorly for several months; the coke consumption and flue dust losses were high, which caused him to believe that his furnace was badly "scabbed up." He had several test holes drilled in the inwall and found this to be true. There was also a strong odor of potassium cyanide at the holes. He immediately started reversing his filling. That is, the coke was charged on the bell first, after which the ore was charged. This procedure was followed for several hours each day, the amount being increased on each succeeding day. In about four days the furnace "cleaned off" and made several high-sulphur casts of iron, after which she straightened out and ever since has been one of the outstanding furnaces in the country on slow wind.

The use of "cleaners" is a subject on which many furnace men disagree. Some prefer to "slug" the furnace with charges of siliceous material such as mill cinder, brick bats, Bessemer slag, or high silica ore. The writer has had one particularly successful experience with this type of "slugging." A furnace, operating on 27,000 cu. ft. per min. of wind at the time, was not carrying the normal burden and generally was operating poorly. The significant figures for the treatment are shown in the table.

From this table it can be seen that the first "slug" was charged on the nineteenth day of the month. About 14 hr. later the furnace got quite "sloppy" at the tuyeres and kept this way for several days, although this condition gradually diminished. The furnace came up "hot" or high in silicon as soon as the sloppy condition started, and burden was added at once to bring the silicon down. In six days' time enough burden had been added to reduce the theoretical coke rate 255 lb. per gross ton of pig iron. This theoretical coke rate is very close to the actual coke rate and is used because it is an excellent index of the furnace operation at the time. Because of the successful results obtained in this trial, the writer prefers to "slug" his furnaces at regular intervals when the wind is brought down to about 30,000 cu. ft. per min.

Incorrect Ore Blanket Causes Channeling

Concerning the distribution of stock and analysis of the gas, the ideal condition is to complete the reduction of iron ore and calcining of limestone in the upper part of the shaft at temperatures below 1000 deg. C., allowing no production of CO_2 at temperatures higher than this. The more intimate the gas-solid contact in the upper part of the furnace, the more nearly will conditions approach those in the ideal furnace advocated by Gruner. Commercial operation never attains this ideal, as furnace investigations show that 20 to 80 per cent of the reduction is carried on below the top of the bosh, in the hotter part of the furnace.

On one occasion the top gas of a certain furnace was found to be very low in CO_2. The furnace had not been carrying the usual amount of burden, so immediately some tests were run on samples taken at 9 in. from the inwall. These showed the gas to be channeling through the center, so a heavier ore layer was charged and the results were gratifying.

At another time it was found that the gas was traveling up the walls. A lighter ore layer was put on by a change in filling, after which the furnace performed normally.

It must not be concluded that the attempted solutions of furnace problems in this manner are always successful. Changes can often be made, presumably in the right direction, with no beneficial effects on the furnace. The writer is firmly of the opinion, however, that when the channeling of the gas is caused mainly by the use of a filling in which the size of the ore blanket is incorrect, the practice on the furnace will be improved by a method of procedure similar to that described above.

The uniformity of the blast temperature distribution at the tuyeres is best checked by installing thermocouples in the tuyere stocks. Any discrepancy in these temperatures is due either to the incorrect location of the cold air mixer line connection with the hot blast main or poor design or location of the hot blast main itself. Tests of this nature were made on three furnaces operating in the same plant with hot blast mains of the same size and design, but with different mixer connections. The mixer connections were located (1) at the extreme end of the hot blast main away from the furnace, (2) at the hot blast valve well on each stove, and (3) between the stove nearest the furnace and the bustle pipe connection. The first two named showed practically the same temperatures on opposite sides of the hot blast main connection, but the last showed a variation of at least 100 deg. F. at all times.

The quantity of wind discharged by each tuyere was checked by determining the difference in pressure in a 36-in. length of the blow pipe. This was obtained by inserting a tube in the peep sight hole of the tuyere stock. This tube had two holes drilled 36 in. apart to which were fitted two small pipes in order to obtain the difference in pressure from one hole to the other. The differential pressures across these two small pipes were read from a mercury column. Not enough data has yet been checked to determine the value of these tests, but it is believed that they will eventually be of some practical use.

The correct tuyere area for each different volume of blast blown has been a point on which many furnace men disagree. One well informed operator has stated that a figure

of 6.75 sq. in. of area per 1000 cu. ft. of blast per min. is correct. Another operator states that a constant of 6.25 sq. in. is better for his practice. These figures indicate that some furnace men are of the opinion that the velocity of the blast at the nose of the tuyere must be held constant. The writer's views can best be demonstrated by a review of one experience. The blast volume of a furnace had been decreased to 28,000 from 38,000 cu. ft. per min. This was the lowest point at which the wind had been held on the furnace at that time. The furnace had done excellent work on 38,000 cu. ft. per min. with twelve 5-in. by 12-in. tuyeres, so when the wind was lowered the new area was proportioned according to the constant velocity theory in this manner:

Tuyere area for 38,000 c.f.m. $= 12 \times 0.786 \times (5)^2 = 236.0$ sq. in.

Tuyere area for 28,000 c.f.m. $= \frac{236 \times 28{,}000}{38{,}000} = 174.0$ sq. in.

Blast Energy Should Be Constant

Accordingly, nine 4-in. x 12-in. tuyeres were installed, making the area 172.2 sq. in. The furnace did not work smoothly and it required constant checking to keep her moving. The iron looked cold in the runner in spite of the fact that the analysis was within specifications. Some temperatures as low as 2500 deg. F. were read on an optical pyrometer, whereas the iron normally ran around 2700 deg. F. It was noticed that the 4-in. tuyeres were "dead" with very little action, while the 5-in. tuyeres showed normal movement of the coke. The thought then occurred that the weight of the blast entering each tuyere was a factor, as well as the velocity, in producing normal tuyere action. A review of the investigation by J. E. Johnson, Jr., on mechanical principles disclosed the fact that he was of the opinion that the energy of the blast jet was proportional to the square of the velocity. He said that "the energy of the blast jet also varies as the square of its velocity" and that "this energy represents the ability of the blast jet to overcome resistance in its line of action—in other words its penetration."

From this it seemed likely that the kinetic energy of the blast jet should be held constant for all wind volumes blown. The decision was then made to solve for the value of this kinetic energy for the practice on 38,000 c.f.m. of wind, which was as follows:

Q_1 = Volume of blast at 60 deg. F. and 30 in. Hg = 38,000 c.f.m.

P_1 = Pressure at the bustle pipe = 14.1 lb. per sq. in.

T_1 = Temperature of the blast at the bustle pipe = 1315 deg. F.

M = Weight of blast in lb. per sec.

S = Specific volume of air at 60 deg. F. and 30 in. Hg = 13.10 c.f. per lb.

Then $M = \frac{Q_1}{60S} = \frac{38{,}000}{60 \times 13.10} = 48.1$ lb. per sec.

Allowing for a 1.5 lb. per sq. in. drop in pressure from the bustle pipe to the tuyeres.

$P = P_1 - 1.5 = 14.1 - 1.5 = 12.6$ lb. per sq. in.

When P equals the actual air pressure at the nose of the tuyeres in lb. per sq. in., allowing a 30 deg. F. drop in temperature from the bustle pipe to the nose of the tuyeres.

$T = T_1 - 30 = 1315 - 30 = 1285$ deg. F.

Where T = the actual air temperature at the nose of the tuyeres in deg. F.

$$Q = \left(\frac{Q_1}{60}\right)\left(\frac{T + 460}{60 + 460}\right)\left(\frac{P}{P + 14.5}\right) = \left(\frac{38000}{60}\right)\left(\frac{1285 + 460}{60 + 460}\right)\left(\frac{12.6}{12.6 + 14.5}\right) =$$

988 c.f.s. where Q = actual volume of air at the nose of the tuyeres in c.f.s.

$$A = \frac{(12)(0.786)(5^2)}{144} = 1.64 \text{ sq. ft.}$$

Where A = Free area of the tuyeres in sq. ft.

$$V = \frac{Q}{A} = \frac{988}{1.64} = 603 \text{ f.p.s.}$$

Where V = actual velocity of air at the nose of the tuyeres

$K = MV^2 = 48.1 \times 603^2 = 17.5 \times 10^6$

Where K = a constant

The conditions for 28,000 c.f.m. were as follows:

$Q_1 = 28{,}000$ c.f.m. at 60 deg. F. and 30 in. Hg

$P_1 = 12.8$ lb. per sq. in.

$T_1 = 1400$ deg. F.

$$M = \frac{28{,}000}{60 \times 13.10} = 35.5 \text{ lb. per sec.}$$

$$P = 12.8 - 1.5 \times \frac{28{,}000^2}{38{,}000^2} = 12.0 \text{ lb.}$$

per sq. in.

$T = 1400 - 30 = 1370$ deg. F.

$$Q = \left(\frac{28{,}000}{50}\right)\left(\frac{1370 + 460}{60 + 460}\right)\left(\frac{12.0}{12.0 + 14.5}\right) = 744 \text{ c.f.s.}$$

Solving for A:

$$K = \frac{M(Q)^2}{(A)}$$

$$A^2 = \frac{MQ^2}{K}$$

$$A^2 = \frac{(35.5)(744^2)}{(17.5)(10^6)} = 1.12$$

A = 1.06 sq. ft. or 152.5 sq. in., which equals the tuyere area.

Tuyere Replacement Produces Normal Operation

The three 5 x 12-in. tuyeres were replaced by 4 x 12-in. tuyeres, making the total area 151 sq. in.

At once the tuyeres were normal, and in a few days the furnace was working smoothly and the iron was hot enough.

The value for *K* at another plant was found to be 16 instead of 17.5, which difference is believed to be due to a difference in the coke.

If the above mentioned fundamentals are complied with, the furnace should show a substantial decrease in fuel consumption and flue dust losses, in spite of the fact that the radiation loss is a constant value per unit of time, and hence the percentage increases directly with the decrease in daily production.

It is believed that the principal reason for a great decrease in flue dust production on slack wind is the decreased velocity of the top gas at the stock line. It is generally conceded that the lifting effect on a given particle in a gas stream is proportional to the square of the velocity. As the velocity of the gas varies directly with the wind volume and the tonnage varies in nearly the same manner, the result is that the amount of flue dust produced per gross ton of pig is almost in direct proportion to the blast volume. The decreased channeling effect of lowered blast volumes also affects the flue dust production, in that the mean value of the squares of the velocities at each unit area of the stock line is lower.

The question may arise as to how fast the wind can be increased or decreased on a furnace without seriously affecting the operation of the furnace and the quality of the product. It has been the writer's experience that the wind can be increased at the rate of 2000 to 2500 cu. ft. per min. each 24 hr. and decreased at twice this rate, provided that the walls are fairly clean and that the correct tuyere size is used at all times. It has been found that, where the wind was increased substantially, the practice for the first month of operation on the higher blast volume was unsatisfactory. At the end of this first month the furnace was generally operating normally.

The question of just how low it is possible to go with the wind on a given furnace is often asked. It is our opinion that the minimum size of tuyeres could be the limiting factor. It would probably be possible to operate on 2-in. tuyeres, but we feel that if the size were any smaller great difficulty would be experienced. Another consideration is that the bottom and walls of the hearth tend to build up on low wind. It is altogether possible that the bottom might build up to the point where the product could not be extracted from the tapping hole. Fuel consumption curves for

(CONCLUDED ON PAGE 38)

Problems in Steel Melting

Howe Memorial Lecture

By E. C. SMITH

Chief Metallurgist, Republic Steel Corpn.

o o o

OF the numerous methods of melting steel, the basic open-hearth process dominates the industry of the world. The Bessemer process is second, and the several other methods, although important, are not large tonnage producers. In any review of steel-making, the basic open-hearth usually occupies the most prominent place, for it must be considered that in this nation this unit produces more than four-fifths of all the steel that is consumed. It can make steel from such variable raw materials, and under such a wide variety of conditions, that it represents a splendid example of an industrial idea that has but started on its way. It presents many problems. Some will be outlined in the following subject matter with the hope that more exact knowledge may be obtained by specialized study by those equipped to handle the many different phases.

To melt steel commercially requires a structure which is capable of withstanding temperatures which are close to 3000 deg. F. The furnace structure must be within economic bounds, established by the commodity under consideration. Thus, we find the electric steels produced on bottoms which can be of higher cost than is used for the simpler open-hearth steels. The structure is a varied assemblage of material, each selected by experience, to construct a workable tool. With this in mind we may proceed with the presentation of one of our important problems.

The generation of temperatures close to 3000 deg. F. has been mastered commercially in many ways. There are electric-heated units capable of a commercial temperature far in excess of this figure. The method of generation of heat and the upper commercial limit are of extreme importance. A melter is concerned with a series of reactions which never reach equilibrium; in fact, they approach equilibrium from but one side. That is, pig iron is never commercially made in the steel melting unit. It is important that the time element and the temperature function be known, for what can be accomplished with increased time can usually be hastened by increased temperature. All melters, therefore, should be concerned with the heat generating scheme as a variable phase of a complicated shifting set of conditions, for they are not working with known phases in a closed system.

There are two major commercial heat-generating schemes. Fuel can be burned which, in principle, means a combination of gaseous material with air. Such a condition is oxidizing in practice, and has a commercial peak but little in excess of the 3000 deg. F. required. An electric current may be used to generate heat, in which case a temperature well in excess of 3000 deg. F. can be secured. In addition, the gaseous phase of the system can be kept more reducing. Thus there is available a fundamental variable to use and the problem becomes one of selection of the open-hearth furnace as against the electric furnace. The proper choice must depend upon the reactions required; the open-hearth furnace, where oxidizing reactions are desirable, and the electric furnace where reducing reactions are more useful.

Above the melting hearth the material usually selected to withstand the temperature is silica brick. If its peculiarities are properly understood, it is an extremely able refractory. The silica is bonded with lime and burned at a temperature and for a time sufficient to convert nearly all the quartz to the form of tridymite. A further change takes place during service, and when properly handled at high temperature the working surfaces are modified to a form known as cristobalite. Silica is peculiar in that the modifications have successively higher melting points. The melting point of quartz is 2804, and the deformation on melting is very slow. The melting point of tridymite is 3339, and again the deformation is slow. The melting point of cristobalite is 3414, and the deformation not rapid unless the superheat is excessive. Neglecting the volume changes, which are very important below the working temperatures, a refractory is thus available which will stand more abuse in heat if time for phase changes is provided. In this manner the commercial range of usefulness can be extended nearly 200 deg. F. by proper handling.

The contamination of the exposed surfaces brings about an interesting set of conditions. The condition of service most desirable is a fair degree of oxidation, for when a metallic splash is converted to iron oxide it hardly combines as long as it is kept oxidized. The basic materials which come in contact combine rather readily, but the iron combination is very intimately associated with the degree of reducing conditions.

The section of a roof brick after a service campaign shows in the working face a large amount of crystalline cristobalite twins, a small amount of magnetic oxide of iron, and still lesser amount of iron silicate fayalite. If the amount of iron oxide present were all combined as iron silicate, the mass would soften quickly. If the conditions in a furnace become definitely reducing for even very short periods of time, the higher form of iron oxide can change with the resulting formation of the lower melting iron silicate. Destruction is prompt and continues to temperatures below 2500 deg. F. *As much as an inch of furnace roof has been destroyed in less than five minutes* in experimental work involving reducing atmospheres. Thus there is present the problem of control

(CONTINUED ON PAGE 86)

Improvements in Production

Improved Plunger-Type, Die-Casting Machine

AN improved model, No. 500, heavy-duty, plunger-type, die-casting machine for the pressure die casting of zinc and zinc alloys, is announced by Newton-New Haven Co., New Haven, Conn. The machine is semi-automatic in that the operator moves two levers during the cycle of operation. All other machine movements are automatic. The equipment is illustrated below.

The lever A closes and locks the dies through a cam movement, and likewise serves in unlocking after the casting shot is made. Lever B controls the shot of molten metal through the release of the air pressure loading-plunger within the plunger cylinder. A dog provides that the shot can not be made unless the dies are in locked position. The plunger cylinder is located to permit molten metal being reservoired extremely close to the die cavity in its idle position.

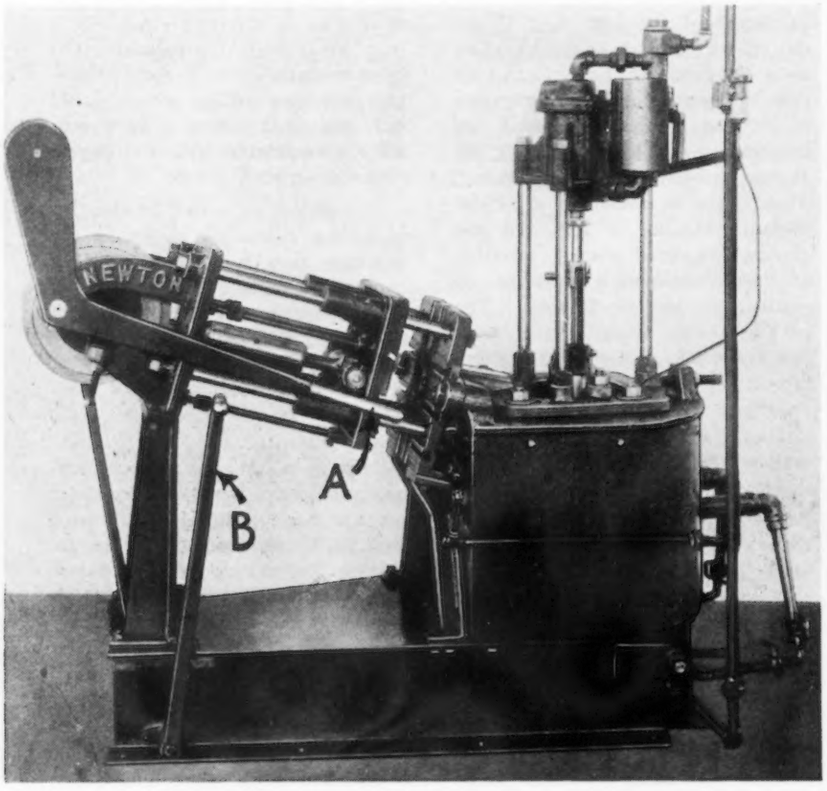
This provides quick entrance of the metal into the die when the shot is made. In connection with this feature the air valve is located directly upon the cylinder, thus providing that there is no necessity for building up air pressure within a confined space between the valve and the metal. One hundred lb. pressure in the 6-in. cylinder gives approximately 2800 lb. for high speed metal movement. This design features the small quantity of air to be displaced by the molten metal on its way to the dies.

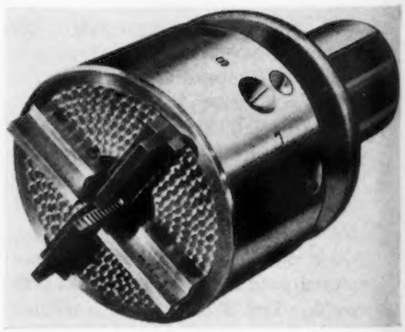
The die carrying steel bolsters are T-slotted for self-alining dies. One bolster is slidably mounted on four bars, with the sliding action at approximately the bolster corners. One of the four bars is removable for the elimination of any obstructing condition to the quick mounting of dies having core-pulls. A fifth bumper bar at the bottom of the sliding bolster facilitates ejection in the case of overhanging dies. Roller bearings are used in the main cam ring and shaft bearing.

The open design is stressed as providing profitable operation on short and moderate runs of work as well as on large quantity runs.

Unused air pressure in the down-stroke of the plunger is bypassed into a separate air cylinder and automatically used for the up, or positioning, stroke of the plunger; by this design the cycle of the plunger is completed with one shot of air.

A special alloy iron is used in





ABOVE

New Chaser and Holder Feature Die Head—Three sizes of holders accommodate the range of chasers used with this new die head. Interchangeability with certain other heads is a feature.

See page 35, column 1.

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AT LEFT

Improved Plunger-Type Die Casting Machine—Embodies open design die-bolster mounting to facilitate die setting.

See above.

and Shop Equipment . . .

the pot, cylinder and plunger construction. The furnace is a welded steel plate fabricated unit, with cast steel top plate. Metal is melted by atmospheric gas burners under thermostatic control.

New Chaser and Holder Feature Die Head

FOR threading work where changes from one job to another are frequent, and in which rigidity in construction and precision in work are essential, a new interchange chaser blade and holder has been brought out by the National Acme Co., Cleveland. See opposite page.

The blade chaser slips into a slot in the block, protruding on each end. On one end are the threads of the chaser with the ground cutting edge; on the other end a heel or cam is ground which is seated snugly in the cup and assures accurate opening action.

By building the cutting edge and the heel into one blade it is stated that correct location of cutting edge is secured, and each chaser will take the same depth of chip, which is a factor in accuracy of lead.

The blade is wider than the depth of the slot, making more grinds possible. It is made of the selected high-speed steels and fastened to chaser holding block with two hollow hexagon screws. Only two sets of blocks are required for entire range of cutting sizes.

These chasers and blocks are interchangeable in the dies with the circular chasers and holding blocks of corresponding die size, in the rotating or non-rotating series. The chasers are made in stockable sizes from ¼ in. to 1 in.

New Multiple-Operator Arc Welders

IN the multiple-operator a.c. or d.c. arc welder pictured below, the voltage is adjustable at each welding station independently of and without interference with the other stations. By means of a booster arrangement the voltage is increased or decreased, so that not only may the current be varied at each station but the voltage may be adjusted also—an important feature in welding thin material, stainless steel, aluminum, Monel and other metals. The outfit is made by the Electric Arc Cutting & Welding Co., Newark, N. J., and patents have been applied for.

ABOVE

Holding Device for Tap Chaser Grinding — Convenient adjustments and holding means are provided for rake grinding or sharpening collapsible tap chasers by this attachment.

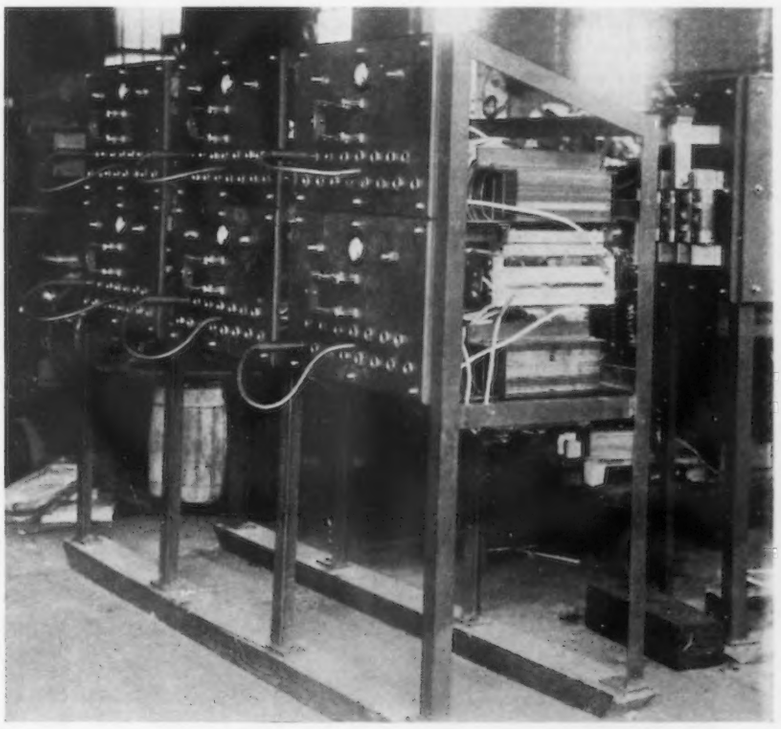
See page 36, column 3.

o o o

AT RIGHT

New Multiple-Operator Arc Welders —A booster arrangement provides that current can be varied at each station and voltage adjusted.

See column 3 above.



New D.C.-Type Motor with Stationary Commutator Operates from A.C. Source

A NEW type electric motor, which utilizes a "stationary commutator" and has the characteristics of a series-type d.c. machine but which operates from an a.c. power source, has been developed by E. F. W. Alexanderson, consulting engineer, General Electric Co., Schenectady, N. Y. Known as a "Thyratron" motor, the new development is made possible by recent advances in the application of electron tubes. Announcement was made in a paper by Doctor Alexanderson and A. H. Mittag, also of the General Electric Co., which was discussed on Jan. 24 at the A.I.E.E. winter convention in New York.

One motor of this type, intended for use in driving an induced-draft fan, has already been built and is now on test in the Schenectady works. It is rated 400 hp. at 625 r.p.m. and 75 hp. at 350 r.p.m. These are the specified ranges of horsepower and speed for the particular application, although the motor may be successfully controlled down to standstill, if required. The equipment operates from a 2300-volt, three-phase, 60-cycle power supply. See below.

Noteworthy features include:

(1) While running from alternating current, the motor has the characteristics of a series-type direct-current machine.

(2) The speed of the motor is independent of the frequency of the power supply.

(3) Smooth control of the speed can be obtained over the full range.

(4) In event of a momentary interruption of the supply circuit, the motor will, upon the restoration of power, start and return to the speed at which it was previously operating, without drawing excessive current from the line.

(5) The efficiency is high and the efficiency curve relatively flat—a distinct advantage, particularly in the lower portion of the speed range.

Because of these characteristics, motors of this type are said to be applicable to such auxiliaries as fans, centrifugal pumps, compressors and similar equipment having load characteristics such that the series type of motor can be used to advantage.

The motor has a stationary armature and a revolving field of the type used in synchronous motors. The armature, however, is provided with a special winding. Unidirectional current is supplied by means of a group of full-wave rectifiers which operate from the three-phase, 60-cycle current source. The operation of the Thyratron rectifiers is controlled by means of grids in these tubes so that power is supplied to the motor windings in the proper sequence and amount necessary to give the required torque for operation. This control is obtained by means of a small distributor mounted on one end of the motor shaft. Speed control is obtained by varying the voltage supplied by the motor armature, by means of a phase-shifting device acting upon the same grids in the Thyratron tubes. Through this method it is possible to obtain smooth speed control over the entire range for which the motor is designed.

The revolving field of the motor is connected in series with the neutrals of the armature windings and, as a result, the motor has the characteristics of the well-known series-type, direct-current motor.

AT LEFT

New D.C.-Type Motor with Stationary Commutator Operates from A.C. Source—Part of the equipment of the new electrical motor.

See above.

Holding Device for Tap Chaser Grinding

THE Landis Machine Co., Tap Division, Waynesboro, Pa., has placed on the market an attach-

ABOVE

Flexible Support-Unit for Steam Connections—Prevents sagging and resultant water-pockets.

See page 37, column 2.

o o o

ment or fixture for sharpening or regrinding chasers used in certain of the company's line of collapsible taps. This device, pictured on page 35, is made up of three main parts; first, a base which is adapted for fastening to the table of most makes of tool and cutter grinding machines. Attached to the base is a second part, the swivel bracket, which is adjustable in a horizontal plane in relation to the base. The bottom part of the swivel bracket is graduated to permit obtaining the desired degree of azimuth, which is the angle at which the chaser is set from the parallel. The third part of the attachment is the vise base which is clamped to the swivel bracket and which holds the chaser while being ground. The vise base can be rotated in the vertical plane and securely clamped at any angle as determined by graduations on the top of the swivel bracket. This permits setting the chaser at the proper elevation for grinding the gun tap in the throat section of the rake.

The vise base is provided with a milled flat which will accommodate all sizes of tap chasers. The chaser is held in place by an adjustable spring clamp and locked with a hand screw.

The attachment is suitable for grinding all sizes of chasers employed in the Landis style LT collapsible taps, the style LM receding chaser collapsible taps and also those employed in the Victor collapsible and receding chaser taps formerly manufactured by the Landis Machine Co., or the Victor Tool Co.

Flexible Support Unit For Steam Connections

FLEXIBLE steam connections which will maintain self-draining in any position resulting from use with movable platen presses are announced by the American Brass Co., American Metal Hose branch, Waterbury, Conn.

The conducting element is a special bronze seamless-drawn tubing free from joints and packing. Deep helical corrugations, die-formed into the tubing, provide the necessary flexibility.

The supporting element, shown in outline on page 36, is a new patented brass bracket, so attached to the tubing that not only does it act as a support but functions so that the flexing of the tubing shall be equal at all points. The assembly is applicable to either series or individually connected platens and is said to control tubing movement within well defined limits.

High Energy Torsion Impact Testing

THE Baldwin-Southwark Corpn., Philadelphia, announces the Carpenter torsion impact testing machine which has available, at 1000 r.p.m., 50,000 ft-lb. of energy —sufficient to test any known steel, under usual testing conditions, in specimen diameters up to 1 in., and up to 1¼ in. to 1⅜ in. diameter in many steels. The equipment is shown below. The principles involved are identical with those of the former 500 ft.-lb. machine. A refinement, however, is the incorporation of a magneto-type tachometer.

Mobile-Rig Rock Drill

A RECENT addition to the light weight, mobile-rig drilling equipment manufactured by the Worthington Pump & Machinery Corpn., Harrison, N. J., is styled "Rock Master" and, as shown at left, permits of drilling from almost any angle with an easily portable outfit. It is said that this equipment can be taken to any job where a hand drill can be used. Adjustable peg-legs and U-bar, in combination with the universal seat of the drill, provide the wide range of set-up and the rigidity feature. Furnished with feeds to accommodate 3 ft., 4 ft., or a 6-ft. max. steel change, the equipment is said to handle 20-ft. depths.

ABOVE

Mobile-Rig Rock Drill — This "Rock Master" drill features the ease with which almost any angle of drilling can be accomplished.

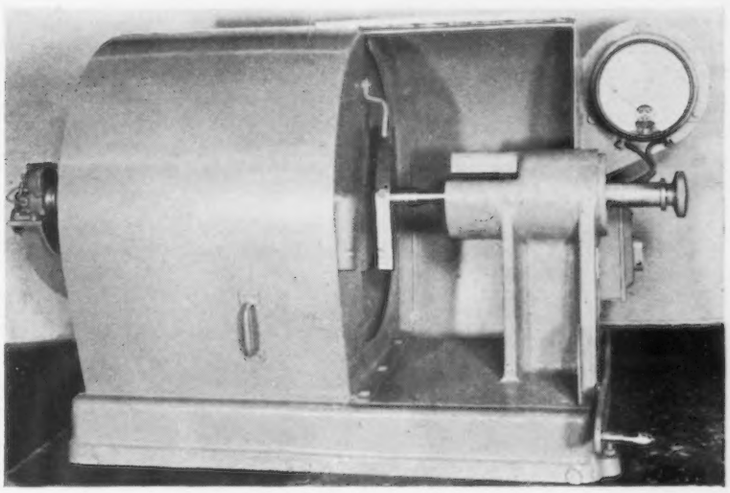
See column 3 above.

o o o

AT RIGHT

High-Energy Torsion Testing — One hundred times the torsional energy stored in previous machines is available with this new equipment.

See column 3 above.



Observations and Theory on Slack Wind Blast Furnace Operations

(CONCLUDED FROM PAGE 32)

several furnaces have shown that the rate of decrease of coke consumption is lower with each corresponding decrease of wind. This implies that the coke rate will reach a minimum at some low volume and then increase as the wind volume is lowered still more. This point is where the fuel economies affected by the low wind and resulting efficient gas-solid contact exactly balance the ever increasing radiation and cooling water loss.

Many Furnaces Over-Blown

It is the writer's conviction that practically all blast furnace operators in this country were over-blowing their furnaces prior to the depression, by reason of the data set forth. There is one particular volume of blast for each furnace that will produce a certain tonnage of iron at a cost lower than the cost will be at any other blast volume with the same raw materials, prices, labor costs, and equipment. It is the duty of each operator to determine this point on each furnace under his supervision, and thus arrive at the most economical rating for each size furnace operating under the given set of conditions. Thus when a furnace is to be relined or rebuilt the operator will know the size furnace to build in order to produce the tonnage required, in the same manner that an electrical engineer determines the size of motor to be installed when he is acquainted with the average, minimum, and maximum load and speed requirements.

Experimental data have shown that the large-hearth, high furnace with the wide top is the best for Lake ore practice. This large tonnage is concerned, and is more furnace is very flexible as far as economical to operate when the conservation of raw materials is considered. A Republic furnace, for instance, with a 27-ft. hearth produced a minimum of 347 gross tons of pig per day over a four-month period, and made as high as 811 gross tons of pig per day. It is believed by the operators of this furnace that it is possible to produce 1200 gross tons of pig per day. This is a production regulation of $\frac{100\ (1200-347)}{1200}$ or 71.2 per cent.

The decreased coke rates and flue dust productions on slow wind are due partly to the decreased volume of blast and partly to the slowing up of the descent of the column of stock. It is impossible to determine, at the present time, the relative effect each of these conditions has on the increased economical working of the furnace, but it is the writer's opinion that the lower blast volume has the greater effect. This would mean that the much talked of practice of increasing the oxygen content of the blast might be developed, in order to produce the required tonnage of iron and still keep the total volume of blast down low.

It is possible to use heavy batters on the furnace inwall with low volumes of wind, but when high volumes are blown it is believed that this reacts unfavorably on the furnace practice. Too small a batter retards the descent of the stock, and this often results in the "hanging" or uneven movement of the charge. Inwall batters may be roughly classified as follows:

1—Light batter—under 0.8 in. per ft.
2—Medium batter—from 0.8 to 1.0 in. per ft.
3—Heavy batter—over 1.0 in. per ft.

We favor the medium batter in the range of from 0.8 to 0.9 in. per ft.

More research and experimentation should be done on the gas flow in the blast furnace, in order to determine the location of the greatest channeling. Once this has been satisfactorily determined for the conditions present, then intelligent effort can be made to correct the bad features of the gas flow by changes in filling or design of the top-charging mechanism and furnace lines.

Furnace Characteristics During a "Slugging" Operation

Day of Month	Theoretical Coke Rate, Lb. per G.T. of Pig	Burden, Lb. per Charge	Average CO_2 in Top Gas Per Cent	Remarks
19	1,957	20,000	12.7	Charged 40,000 lb. of mill cinder
20	1,892	20,600	12.6	Charged 41,200 lb. of Bessemer slag
22	1,847	21,200	14.0	Charged 20,000 lb. of siliceous ore every 8 hr. and continued
23	1,750	22,400	14.2	
25	1,702	23,000	14.3	

Corrosion in Air Conditioning Discussed

AIR conditioning of commercial and apartment buildings, as a means of increasing revenue, increased rentals and satisfied tenants, and the dangers of corrosion in such apparatus, were discussed recently by William L. Keplinger, sales manager, Carrier Engineering Corpn., Newark, N. J., and George W. Martin, supervising engineer, United States Realty & Improvement Co., New York, at the regular monthly dinner meeting of the management division, Real Estate Board of New York, Inc.

Mr. Martin, who is chairman of the research committee of the management division, stated that the operation of air conditioning apparatus has presented a problem of corrosion of the equipment which, however, seems to be in a fair way of solution.

The passage of air through a water spray, he said, the water being collected and used again, will build up in the water a concentration of impurities in the air, such as carbon monoxide and dioxide, nitrogen oxide, ammonia and sulphur. Marked galvanic action has taken place in some cases due to the use of dissimilar metals in various parts of the apparatus, he stated, and in one case the entering air was so polluted with sulphuric acid fumes that the intake fan and housing are showing signs of corrosion.

Mr. Martin described the work of his committee in dealing with the problem, explaining that the treatment for its prevention, caused by concentration of acidity in the water, followed somewhat that for water pipe corrosion, except that a higher caustic alkalinity must be maintained. The treatment for corrosion of metal having no contact with water seems to be, he continued, a corrosion resisting paint or coating, but up to the present nothing has been found to resist the effect of the sulphuric acid fumes.

NEWS OF THE WEEK

Production of Light Products Showed Largest Gain in 1934 Steel Output

STEEL production, higher in 1934 than in 1933, reflected the increasing importance of the lighter steel products, according to an analysis of the industry's production records just announced by the American Iron and Steel Institute.

Production for sale of all code steel products by members of the code in 1934 totaled 21,174,628 gross tons, a 10 per cent increase over the 1933 total of 19,243,791 gross tons. More than three-fifths of this increase came from expanding demand for sheets, strip, wire and other light products for which production aggregated 9,018,000 gross tons in 1934, approximately 15 per cent higher than the 7,836,000 gross tons produced in 1933.

In 1934, as in the preceding year, sheet steel production ranked above all other products in tonnage. The total of 3,715,475 gross tons of sheets rolled in 1934 was almost 17 per cent more than in 1933, and was equal to 41 per cent of the industry's sheet producing capacity.

The greatest percentage gain over 1933 figures was made by the mills rolling standard rails (weighing over 60 lb. per yard). The 1934 production of 905,892 gross tons was 163.2 per cent over 1933. Other noteworthy improvements over 1933 were registered by steel piling, 105.1 per cent; all rails, tie plates, car wheels and axles, 96.8 per cent; plates, 37.6 per cent; structural shapes, 30.4 per cent; pipe and tubes, 25.2 per cent.

Indicative of the general rise in manufacturing activity during 1934, production of tool steel bars, raw material for most of the nation's cutting tools, increased 38.7 per cent over 1933.

Tin plate production, which in 1933 amounted to 8.8 per cent of the total tonnage of the year, dropped 11.1 per cent below the total of the preceding year. Also below 1933 production were tube rounds, down 43.0 per cent; wire rods, down 17.9 per cent; wire and wire products, down 16.1 per cent.

Production of iron products in 1934 aggregated 113,835 gross tons, a 35.3 per cent increase over 1933. An average of 20.1 per cent of capacity for iron products was maintained throughout the year.

PRODUCTION FOR SALE OF STEEL CODE PRODUCTS

	Produced for Sale, Gross Tons		Per Cent
	1934	1933	Change
Ingots, blooms, billets, etc...	3,082,664	3,129,772	—1.5
Heavy structural shapes	1,140,267	874,547	+30.4
Steel piling....	103,354	50,383	+105.1
Plates	1,261,406	916,840	+37.6
Skelp	352,461	281,758	+25.1
Rails	1,004,151	406,143	+147.2
Splice bars and tie plates....	312,597	175,546	+78.1
Tool bars.....	3,192,056	3,010,157	+6.0
Tube rounds...	44,707	78,423	—43.0
Total steel bars	24,458	17,637	+38.7
Pipe and tube..	1,538,444	1,228,564	+25.2
Wire rods.....	363,818	442,880	—17.9
Wire and wire products	1,349,833	1,608,615	—16.1
Black plate....	284,168	278,560	+2.0
Tin plate.....	1,510,830	1,699,388	—11.1
Total sheets....	3,715,475	3,182,871	+16.7
Total strip.....	1,714,698	1,677,686	+2.2
Rolled steel car wheels	78,394	62,352	+25.7
Axles	23,968	61,243	—60.9
Track spikes...	67,613	50,270	+34.5
All other.....	9,266	10,156	—8.8
Total code steel.	21,174,628	19,243,791	—10.0
Total iron products	113,835	84,140	+35.3

The accompanying table summarizes the production for sale of the principal steel code products during the past two years:

Navy Is Largest Stainless Customer

THE United States Navy ranks at the top of the list of consumers of stainless steel, according to estimates recently obtained by the American Iron and Steel Institute. Nine different types of stainless steel are used by the Navy in large amounts, the tonnage of the different types varying from ship to ship.

Weight limitation programs are assisted by stainless steel because maximum strength can be obtained with a minimum amount of material. Instead of having to guard against possible loss of strength from rusting by increasing the size or thickness of many parts, considerable dead weight is saved through the use of rust-resisting stainless steel.

In addition to the major uses, in which strength and weight-saving are determining factors, numerous smaller fittings and parts, made of stainless steel, insure dependable operation of important apparatus by their resistance to corrosion. Among these are hinge pins for doors, davit fittings, capstan latches and ratchets, steering transmission shafts and engine parts.

Stainless steel is also widely used on shipboard for food handling equipment and laundry machinery. Recently, stainless steel knives, forks and spoons have been introduced in the Navy's mess rooms.

Increase in British Import Duties May Be Recommended — Action Doubtful

LONDON, Feb. 25 (*By Cable*).—Forward inquiries for pig iron are improved. Orders for semi-finished steel are heavy, and finishing mills are busy, mainly on structural and railroad work. Steel scrap consumption is heavy and supplies are barely adequate.

The import duties advisory committee's decision on import duties is believed imminent, and industry generally is expecting recommendations for an increase. But the Government may ask for a decline as it has expressed dissatisfaction at the progress of the reorganization of the English industry and the failure of the federation to reach an agreement with the Continent. In the meantime, business with the Continent is virtually suspended.

Tin plate demand is good with inquiries for home and export before the trade. Bookings are fair, although still below output. At the Swansea meeting, manufacturers reached an agreement on the Welsh output for coming months and reported that the international agreement was working satisfactorily.

The dullness of the Continental iron and steel markets has increased but is described as a normal development after the heavy unseasonable January buying. It also attributed to the anxiety regarding the cartel's future. The cartel has raised prices for Cuba 2s. 6d. Prolongation of the Continental tube cartel expiring March 31, may be endangered by the recent breakaway of the Homburg Saar works from the German cartel.

British Prices, f.o.b. United Kingdom Ports

Per Gross Ton

Ferromanganese, export	£9
Billets, open-hearth	£5 10s. to £5 15s.
Tin plate, per base box	*18s. 2d. to 18s. 9d.
Steel bars, open-hearth	£7 17½s.
Beams, open-hearth	£7 7½s.
Channels, open-hearth	£7 12½s.
Angles, open-hearth	£7 7½s.
Black sheets, No. 24 gage	£9 5s.
Galvanized sheets, No. 24 gage	£11 5s.

*To May 1; 18s. 5d. to 19s. thereafter.

Official Continental Prices, f.o.b. Continental Ports

Per Metric Ton, Gold £

Current dollar equivalent is ascertained by multiplying gold pound price by 124.14 to obtain franc equivalent and then converting at present rate of dollar-franc exchange.

Billets, Thomas	£2 7s.
Wire rods, No. 5 B.W.G.	£4 10s.
Steel bars, merchant	£3 5s.
Sheet bars	£2 8s.
Plate, ¼ in. and up	£4
Plate, 3/16 in. and 5 mm	£4 2s. 6d.
Sheets, ¼ in.	£4 7s. 6d.
Beams, Thomas	£3 2s. 6d.
Angles (Basic)	£3 2s. 6d.
Hoops and strip base	£4 2s. 6d.
Wire, plain, No. 8	£5 7s. 6d.
Wire nails	£5 15s.
Wire, barbed, 4-pt. No. 10 B.W.G.	£8 15s.

Gas-Operated Air Conditioner

INTRODUCTION of a gas-operated summer air conditioner for homes, commercial structures and industrial plants has been announced by the industrial gas research committee of the American Gas Association. The new unit differs radically from any other summer air conditioning apparatus now available, and is said to offer advantages over conventional electric or turbine driven refrigeration methods. Commercial production of the unit is under way by the Bryant Heater Co., Cleveland, and sales engineering schools will be started immediately in seven cities to promote installations.

Steel Ingot Capacity Now 69,734,701 Tons

ANNUAL capacity for producing steel ingots in the United States as of December 31, 1934, was 69,734,701 gross tons, according to a report just issued by the American Iron and Steel Institute.

No new capacity for the production of open-hearth or Bessemer ingots was created during 1934, in accordance with the provisions of the steel code. The capacity reported for 1934 is slightly more than the 1933 annual capacity of 69,390,625 gross tons, due to the correction of an error which had been made by one producer of open-hearth ingots in reporting too low a figure for 1933.

Blast furnace capacity for producing pig iron was 50,134,241 gross tons annually as of December 31, 1934, a decline from the annual capacity of 50,321,661 gross tons reported for 1933, due to the abandonment of some furnaces. Annual capacity for producing ferroalloys was 846,000 gross tons for 1934, as against 788,400 gross tons in 1933.

Prices Unchanged for Next Quarter

PRICES of iron and steel filed under the steel code for the second quarter reveal no changes from previous quotations. Price changes on a few minor items have been announced for the remainder of this quarter.

Open-hearth iron billets of rerolling quality, f.o.b. Cleveland, have been reduced $1.90 a ton to $34, effective Feb. 14. Open-hearth iron forging billets have been reduced $1.90 a ton to $39, effective Feb. 14.

New prices on 3½-in. and 4-in. buttweld standard steel pipe for structural purposes, f.o.b. Gary, Ind., were put into effect Feb. 21 to rule until March 31. This product has not heretofore been quoted, since the sizes in question have previously been available in lapweld pipe only. For 3½-in. pipe with 4 in. outside diameter, 0.226 in. thickness and 9.109 lb. weight per foot plain ends, the list price is 92c. per ft. For 4-in. pipe with 4½ in. outside diameter, 0.237 in. thickness and 10.79 lb. weight per foot plain ends, the list price per foot is $1.09. For both sizes the basing discounts for black are 66 and 5 and 5 per cent off and for galvanized 57 and 5 and 5 per cent.

ANNUAL BLAST FURNACE AND STEEL INGOT CAPACITIES AS OF DEC. 31, 1933 AND 1934—GROSS TONS

Annual Blast Furnace Capacities

	Pig Iron	Ferroalloys	Total
Dec. 31, 1934	50,134,241	846,000	50,980,241
Dec. 31, 1933	50,321,661	788,400	51,110,061

Annual Steel Ingot Capacities

	Basic O.H.	Acid O.H.	Bessemer	Electric	Crucible	Total
Dec. 31, 1934	60,010,097	944,620	7,895,000	869,364	15,620	69,734,701
Dec. 31, 1933	59,622,517	961,296	7,895,000	895,112	16,700	69,390,625

PERSONALS

HUBERT D. TANNER, who has been identified since 1920 with the Pratt & Whitney Co., Hartford, Conn., has been appointed manager of the machinery division. He started work with the company as an engineer and later was placed in charge of the development of gear grinding machines. Mr. Tanner has also done extensive sales engineering work for the company. He received his technical training in mechanical engineering at Brown University and also attended the Rhode Island School of Design. He was formerly identified with the Brown & Sharpe Mfg. Co.

EDWARD J. O'MALLEY, who has been with the company for the past 21 years, has been made superintendent of all manufacturing divisions in both the machinery and Keller divisions. ALDEN M. DRAKE, heretofore chief engineer, has been placed in charge of a new department for the development of improved machines, tools and appliances for the production of Pratt & Whitney small tools. CARROL KNOWLES, identified with the company for 17 years and formerly a designing engineer for the company, has been appointed chief engineer in charge of the machinery engineering department. R. F. V. STANTON has been made research engineer of the engineering division, EUGENE SULLIVAN has been appointed general foreman of all manufacturing in building No. 4 of the machinery division, and B. G. DENLINGER, general foreman of the Keller division.

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L. K. LINDAHL, since 1929 sales manager of the Udylite Co., Detroit, has been elected vice-president and general manager of the company. He joined the sales engineering staff of the company in 1923, shortly after leaving the University of Illinois.

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DR. HENRY A. BUEHLER, State geologist and director of the Missouri Bureau of Geology and Mines, Rolla, Mo., has been elected president of the American Institute of Mining & Metallurgical Engineers. A native of Wisconsin, he has been engaged in geological work since his graduation from the University of Wisconsin.

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CLARENCE C. MOSACK, formerly secretary and assistant treasurer of the Consolidated Brass Co., Detroit, has been elected president, succeeding HOMER D. COLEMAN, who has been made chairman of the board. Mr. Mosack has been identified with the company for more than 16 years.

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EDWIN E. ELLIS, vice-president of the United States Steel Corpn. in charge of mining, raw materials and Lake shipping, and WILFRED SYKES, assistant to the president of the Steel & Tubes Co. of America, have been elected directors of the American Institute of Mining and Metallurgical Engineers.

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HOWARD G. MOOK has been elected president of the Vandyck-Churchill Co., New York, succeeding the late James R. Vandyck. F. A. BRECHTER has been made vice-president. EARL WAGNER has been appointed second vice-president, with headquarters at the company's Philadelphia office at 1321 Arch Street, and R. M. HOTCHKISS, who has been associated with the company for a number of years, is in charge of the New England office, in the First National Bank Building, New Haven, Conn. WALTER T. CHURCHILL continues as secretary-treasurer.

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M. W. JACKLIN, for the past 13 years with the Lansing Stamping Co., Lansing, Mich., has been made sales manager of the company.

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R. D. HEFLIN has been made Eastern district sales manager of the Gisholt Machine Co., Madison, Wis. He will make his headquarters in the Industrial Building, Newark, N. J.

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FRANK A. LIVINGSTON has been elected president and general manager of the Ralston Steel Car Co., Columbus, Ohio. BLAIR C. HANNA has been appointed manager of sales, and LEON C. ROY, secretary-treasurer.

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DAVID E. ANDERSON, chief engineer of the Bohn Aluminum & Brass Corpn., Detroit, is in Europe studying engine design, particularly in relation to the extensive research work which the company is conducting on combustion chamber and cylinder head design. He will return home in March.

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JUDD W. SPRAY has been elected executive vice-president and a director of the Bower Roller Bearing Co., Detroit.

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WILLIAM A. ROSE has been elected president of the Bassick Co., Bridgeport, Conn., which is a wholly owned subsidiary of Stewart-Warner Corpn. He was formerly vice-president and general manager of the subsidiary.

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MYRON C. TAYLOR, chairman of the board, United States Steel Corpn.; W. J. FILBERT, chairman of the finance committee; W. A. IRVIN, president, and ROBERT GREGG, newly elected vice-president in charge of sales and until recently president of the Tennessee Coal, Iron & Railroad Co., visited Birmingham last week. After inspecting properties of the Tennessee company in the Birmingham district, the party made a one-day inspection trip to Mobile to view the old Chickasaw shipbuilding plant.

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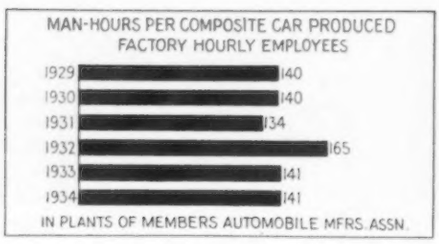
C. W. HEPPENSTALL, president, Heppenstall Co., Pittsburgh, was guest of honor at a dinner at the Hotel William Penn, Pittsburgh, on Feb. 16, commemorating his forty-second year with the company.

H. D. TANNER

L. K. LINDAHL

DR. H. A. BUEHLER



THIS WEEK ON THE

Rush to Get Automotive Steel Now Ended—Steady Demand Assured

DETROIT, Feb. 26.

HAVING run a temperature worrying over getting steel and other materials into its plants in sufficient quantity, the automobile industry is back to normal as the tonnage on hand makes purchasing and production officials feel better. The mad scramble to get on mill rolling schedules is about over and there is less danger that executives are going to acquire high blood pressure fretting over meeting the daily requirements of the assembly lines.

Steel demand, however, is very much alive and is expected to continue healthy for some weeks ahead. In fact, bookings early next month for second quarter deliveries should exceed by a substantial amount the volume of the last few weeks. The Chevrolet gear and axle plant is listed among the steel users destined to place attractive orders shortly.

There probably won't be another cyclonic rush for steel comparable with that which centered at Ford's offices earlier this year, although future tonnages from the Big Three (General Motors, Ford and Chrysler) should continue to brighten the lives of steel mill executives. Because it has been the slowest of the three to get into its stride, Chevrolet is likely to be the largest buyer of steel the remainder of this season.

Ford to Make 160,000 Units in March

Ford is making the most of Chevrolet's predicament of being unable to secure an adequate number of Master models. Its assemblies this month will achieve the goal of 130,000 units set up late in January. The Ford eye is on a 160,000 mark for March, or twice as many cars as the entire industry built last November. That means a daily total of over 6000 units, which is by far the most impressive volume rolled up since the V-eight motor was introduced in 1932. During the first quarter Ford will build over 400,000 cars and trucks in its domestic plants, compared with around 190,000 units in the same quarter a year ago.

Plymouth as well as Ford is profiting at the expense of Chevrolet. Its retail deliveries have been averaging better than 6500 cars a week, and its production has been sustained at or near plant capacity, which is about 45,000 cars a month. This means that Plymouth has been selling well over half its recent assemblies to consumers. Without a great deal of fanfare, Plymouth shortly will announce two standard models intended primarily for the fleet trade and priced, of course, to compete with Chevrolet's standard jobs.

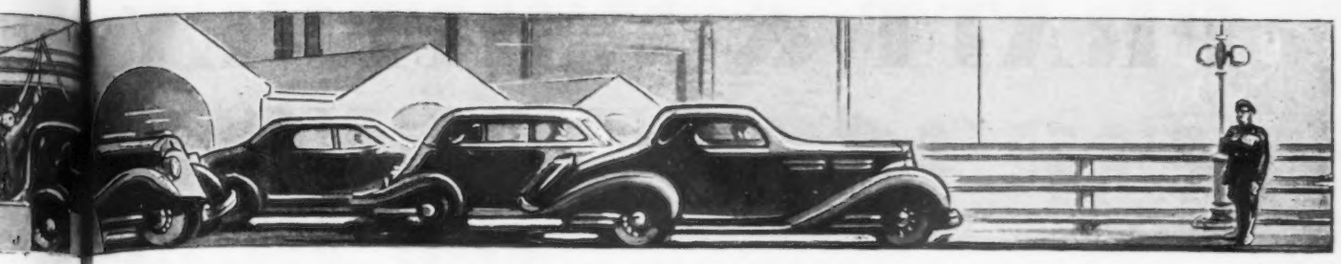
Dodge and Chrysler-De Soto divisions of Chrysler Corpn. are moving along at a swift pace. Indications are that all Chrysler divisions will make 75,000 to 80,000 cars this month and approximately the same number in March.

Chevrolet, handicapped by inability to get sufficient Master bodies, is chafing at this delay, but can't do much about the situation except to wait for the log jam, said to be in the manufacture of the turret top, to be broken. Chevrolet assembly plants around the country are reported bulging with parts which have accumulated during the delay in the receipt of bodies. Some parts makers supplying Chevrolet have temporarily dropped their production rate until things get back into proper balance.

Chevrolet Registrations Favorable

Despite this costly hold-up Chevrolet doesn't seem to be as badly off as it was a year ago. Just as early election returns are deceiving and the results are sometimes reversed by later reports, so the early registration figures for January, mostly from the less populous States, may not be representative of the final returns. Nevertheless, in the first 24 States reporting passenger car registrations for January, Chevrolet sales (practically all Standard cars) were 60 per cent of Ford's, whereas in the same month of 1934 in the same States they were only 32 per cent. There is hardly a crumb of satisfaction in this showing, however, for the company which has its heart set on retaining a leadership which it has held in six out of the last eight years. Chevrolet's new Baltimore assembly plant probably won't be in volume production until April.

Whether Chevrolet achieves its schedule of 80,000 units this month and 90,000 in March depends on two factors, namely, in what volume it gets bodies and avoidance of labor trouble. The Fisher Body plant at Cleveland, where major stampings for Chevrolet bodies are fabricated, is the labor hot spot at the moment and is one of the few



ASSEMBLY LINE

BY BURNHAM FINNEY

Detroit Editor, The Iron Age

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plants in the industry in which the American Federation of Labor is understood to have appreciable strength.

Pontiac Setting Swift Pace

With 700 to 800 cars a day coming off the lines, Pontiac probably will come close to its projected 15,000 cars for February. For March it hopes to make 21,000 cars, but, like Chevrolet, the limiting factor is bodies. Pontiac would be building 1000 cars a day now if it could get the bodies from Fisher. Its dealers still are kicking up a fuss for immediate delivery of more cars than the factory possibly can supply. By the middle of May Pontiac will have assembled as many cars as in all of 1934, according to present plans. Domestic retail sales last year amounted to 72,645 cars.

A new La Salle will be in production early next month. A few may be run through this week. Since almost the entire industry has aped the present La Salle design, it is not believed that changes will be important, although new fender dies have been made. Modifications in fender shape are likely to be minor, however. Cadillac is working on a new V-eight motor, but it is believed the present cars will be continued for some time.

Hudson, which last year accounted for 40 per cent of all cars manufactured by independent companies, had shipped 22,094 of its 1935 models up to Feb. 15, compared with 7413 in the same period a year ago. Its current output is about 2500 units a week.

The February total for the industry should be about 360,000 units and the March output about 400,000. To next month's assemblies Ford will contribute 150,000 units (including Ford of Canada), General Motors 127,000 and Chrysler 80,000. It is no longer a secret that some companies have been producing cars in anticipation of labor trouble so that dealers will have stocks in case factory operations should be interrupted. Retail demand, however, has been so extraordinarily good for the first two months of the year that the influence of this factor in bringing ahead the year's production peak is strongly discounted in well-informed circles. There still is strong belief that April will be the top month of the year from the manufacturing standpoint.

Retail Buying Well Distributed

Retail buying has been well distributed throughout the country, the only section not keeping pace being the citrus fruit belt of Florida, which has suffered heavy losses lately from freezing weather. The Mississippi and Missouri River valleys continue to yield far better business than a year ago. It would be a mistake, however, to get the conception that the biggest market for cars this year will be the agricultural districts. Farmers undoubtedly have more money and are spending it, but they still are far below their former ranking as car buyers. It may surprise some people to know that at least two or three used cars are sold to farmers as against every new car. One company figured out that close to one-fourth of all used car sales are made to farmers.

Car sales to industrial workers, strangely enough, follow closely the trend of car sales to farmers. The market among factory workers, therefore, seems destined to be better this year than last. Here again used cars loom large in calculations.

Overproduction Not Believed Likely

Apprehension still exists in many quarters as to whether car makers have over-produced in the first two months of the year. As yet there is little evidence to support such fears. Ford dealers are eagerly grabbing every car they can get and considerable pressure is being exerted by both dealers and consumers to secure prompt deliveries of certain models.

Of the three major companies, Plymouth probably is in the most comfortable position so far as dealers' stocks are concerned. This isn't surprising in view of the fact that it had several weeks' start on both Ford and Chevrolet. The only case of failure to keep abreast of 1935 sales quotas is that of a maker of medium-price cars which because of lagging demand has been contemplating moving forward the introduction of its 1936 models. Its recent sales, however, have taken a turn for the better.

Labor's Plans Go Awry

Meticulously prepared plans of the American Federation of Labor for causing walkouts in certain key automotive plants apparently struck a snag the past week. President Green began his speech-making tour of automotive cities in militant fashion, saying "if reason fails and logic is ineffective we will lead our forces on the battlefield and fight until we force recognition." His comments in Detroit on Saturday were a far cry from such a belligerent stand if he has been correctly quoted.

"We are not talking about pulling a strike," he said. "We haven't any plans for that. We think in terms of peace."

It appears that Mr. Green's right arm isn't aware of what the left arm is doing. His chief lieutenant in Detroit, F. J. Dillon, made the following statement on the same day that his superior talked in terms of peace: "Nothing shall stop workers from carrying through plans for securing correction of their grievances through the only agency available to them."

PRATT & WHITNEY ANNOUNCES FOR 1935

If your grinding requirements call for a larger machine, ask us. We build hydraulic surface grinders in several sizes, the largest with a wheel 30" in diameter, and various table lengths.

Successful surface grinding requires the right table speed for each job. This new machine with table speeds from zero to 100 feet a minute will give it *for any material.*

Write for our new circular.

A New 14-inch

VERTICAL SURFACE GRINDER

WITH HYDRAULIC TABLE DRIVE

This year, more than ever before, modern equipment is needed to meet competition and make a profit. Surface grinding already has replaced many slower machining operations. Where the nature of the work permits, the trend in this direction is increasing constantly and rapidly. That is why this new P&W Hydraulic Vertical Surface Grinder is finding such rapid favor. It is a profitable investment.

Greatly increased table speed, dependable accuracy and more convenient manipulation have been built into this new P&W Vertical Surface Grinder for 1935. Its table speeds range from zero up to a hundred feet a minute. The smooth hydraulic drive makes available any speed between these limits. That is the reason this grinder can be kept at exactly the right speed for roughing or finishing any job. More than that, the greatly increased table speeds make practical many jobs that never have been ground successfully before. This is particularly true of very thin work.

Find out the saving this new grinder will make in your shop. There is a new circular just off the press which describes the machine in detail and shows many types of work it is doing. Write for your copy. A letter to our nearest Branch Office, or directly to our factory will bring it by return mail. Our Branch Offices are located at Birmingham, Boston, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, Rochester, St. Louis and San Francisco.

PRATT & WHITNEY CO.
Hartford, Conn., U. S. A.

100 Feet a Minute

THIS WEEK IN WASHINGTON

Government's displeasure toward bigness in business reveals many sharp contradictions.

o o o

Billion dollar industrial construction program suggested as sound recovery move.

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Outline for revision of NIRA turned over to Congress with prospect for hot debate.

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Organized labor somewhat appeased by week of victories.

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Administration's grip over Congress weakened by defeat of prevailing wage amendment to public works bill.

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BY L. W. MOFFETT

Resident Washington Editor, The Iron Age

o o o

WASHINGTON, Feb. 26.—The more or less undercover drive against big business is reported to have back of it the idea that the man at the top does not know much about what goes on below. . . . Yet consolidation of rail lines into huge single networks is proposed in the ponderous legislative program. . . . A contradictory policy that utility holding companies, slated for disintegration, cannot understand. . . . All other holding companies are wondering if they are to be listed for slaughter. . . . And so are the millions of small investors in securities of holding companies. . . . They feel that where there has been juggling of stocks, flotation of so-called bonds without real equity, etc., remedy does not lie in a drastic overturning of enormous financial structures through forced liquidation that would leave a path of ruin for these investors and a harvest for professional speculators in depressed securities. . . . They think the Wheeler-Rayburn bill would mean just that. . . .

Since a drive is being directed against bigness and "dominating groups," why not include the Federal Government. It has grown into a super-bureaucracy with a voice in almost every move made by industry and the individual, leaving hardly more than a bare memory of State's rights which once upon a time were so highly regarded that they brought on a civil war. . . .

The idea of bigness seems to be the motive inspiring anti-trust suits, more of which are expected soon. . . . Graduated scales of taxes on corporations according to size, higher rates for the large than for the small corporation actually are proposed. . . . Another idea which is gaining ground, is that something ought to be done, the how of it not being known, about so-called one-industry towns so that when depression hits them they will not have to "close down" and throw their entire population on the streets. . . . Of course Pittsburgh makes many things other than steel and Detroit turns out a few products besides automobiles, but they have been pointed out as shining examples of one-industry towns. . . .

Reaction of Representative Hamilton Fish, fiery anti-New Dealer, to the President's NRA message:

"Business goes to sleep with a headache very night and wakes up with a hangover." . . . Investigations, reports, conferences, studies, surveys, hearings, anti-trust suits, labor agitation, laws without end, make up the pet pastime of Washington as industry tries to recover from the jitters. . . . Paraphrasing T. R., Peace still rages on the Potomac.

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Organized Labor Has Big Week

Organized labor did quite well legislatively last week, scoring victories on the "Hill" that undoubtedly were balm to its wounded feelings. The victories came close together, and, while they promise to be only temporary, they emphasized the influence organized labor wields in the halls of Congress.

On Wednesday the subcommittee of the Senate Committee on Judiciary which recently completed hearings on the Black 30-hr. work week, voted four to one in its favor, thus overriding completely the vigorous protests from industry. On Thursday, organized labor marked up two more victories. Senator Wagner introduced his labor disputes bill, strongly backed by the American Federation of Labor, and the Senate, overriding the Administration by a vote of 44 to 43, sidled up to the A. F. of L. and voted its amendment requiring payment of prevailing wages on emergency public works. The amendment was offered by Senator McCarran. In the House, Representative Connery of Massachusetts prepared to push 30-hr. week legislation differing somewhat from but providing the same rigidity as the Black bill.

The Administration is strenuously opposed to the "prevailing wage" amendment, and, if the huge works relief bill comes to him with the McCarran amendment, it was said he might go to the extent of vetoing the entire measure before accepting the amendment. It is believed that the White House strongly opposes 30-hr. week legislation and likely would veto it if enacted by Congress. Likewise, it is assumed the White House does not favor the Wagner labor disputes bill, details of which were outlined in THE IRON AGE last week. However, the Senator is more hopeful and has expressed the view that it will receive White House support.

The 30-hr. bill died in the House at the last session only because the Administration put forth the NRA. It is now trying to extend NRA while the 30-hr. bill is before Congress, but even the strongest opponents of the bill doubt that NRA can intercede this time to prevent its passage. It is clear, too, that the Administration, despite the overwhelming Democratic majority in both branches of Congress, has seen its honeymoon pass long ago and has much less influence over Congress than it enjoyed in its early days.

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Administration's Grip Weakening

Administration domination can no longer be made so thorough as heretofore on the basis of so-called emergency. Its defeat on the prevailing wage amendment to the works bill plainly demonstrated that even within his own party the President has lost much control, for 21 Democrats voted for the McCarran amendment in the face of the most strenuous efforts of such outstanding Democrats as Majority Leader Robinson of Arkansas and Senator Glass of Virginia to kill the amendment.

Another turn against the Administration within its ranks was the fierce attack made on the works relief bill by Senator Byrd of Virginia. Senator Byrd's onslaught, the first made on the bill by a Democrat, called for defeat of the $4,800,000,000 measure as a reply to the theory that a country can spend its way to prosperity. He assailed many features of the bill, and declared the time had come for the Government to get off "the broad and easy road of extravagant expenditure that leads to destruction." He bitterly opposed the McCarran amendment and said, "If you make the payment of prevailing wages mandatory you will entice millions to leave their regular employment for Federal relief rolls and you will see them fighting to stay there."

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Steel Code Complaints Few; 111 Scrap Objections

The compliance and enforcement division of NRA would have to go out of existence if it had to depend on the iron and steel code for business. This is clearly demonstrated from the division's docket. The latest record, covering the two weeks ended Feb. 2, shows that there were no trade practice complaints either pending or docketed. At the beginning of the two-week period there were nine labor complaints and two were docketed. No violation was found in one case. This left 10 on hand.

The scrap iron and steel code on the other hand showed 111 labor complaints and no trade practice complaints. Twenty - two labor complaints were docketed during the two-week period at the beginning of which there were 132 labor complaints listed, so that 22 were adjusted. No violation was found in 14 cases, four were rejected on account of "faulty bookkeeping" and four were referred to a regional compliance board. "Faulty bookkeeping" means the entry of complaints under the wrong codes or some other error made in the record.

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Basing Point Case Goes on Forever

Men may come and men may go, but the steel basing point case goes on forever. "Investigate" it as they will and as often as the spirit moves them—which is quite often —Government bodies never get done chewing the wind over this popular subject. It concerns "big business" and forays on big business are supposed to pay in big political capital these days.

Though the industry now has some 66 basing points, certain branches of the Government never grow weary of harping on the steel basing point system. It has offered a favorite pastime for certain elements in Congress; it is an obsession with the Federal Trade Commission, and the President apparently finds it entertaining. He ordered a joint study of the basing point system when he renewed the steel code Memorial Day, 1934, and asked that the study be made by the commission and NRA.

These two Government agencies are as close together as the poles on basing point. They didn't make a joint study. Each made its own study. The commission, however, submitted its report to the White House Dec. 1, the time limit which the President had set. The NRA still holds its report. Efforts to get the reports hitched have proved unavailing. The subject is supposed to be very, very delicate, tiresomely so, perhaps, to most everybody except the commission and NRA. The characters of the reports — as if they couldn't be rather easily guessed—are treated as a state secret.

And so they remain stymied. They simply refuse to be coordinated, even under the influence of the suave though not always diplomatic super-coordinator, Donald R. Richberg. Once upon a time, in discussing the basing point system, Mr. Richberg said some very harsh things about the commission. There is much dodging when inquiry is made about the basing point reports. Mr. Richberg was asked last week about them. Oiling the way to rid himself of the

bedeviling subject, he said it was "one of those things that has been pushed off to one side." Blackwell Smith, youthful acting chief counsel of NRA, who has stepped into the shoes left at the Blue Eagle roost by Mr. Richberg, did almost equally as well. Mr. Smith said there was "a job of coordination to be done there and it just hasn't been done."

Meanwhile a palpitating world is almost overcome with languor unmixed with a frightful and growing fear that it may never see the reports. But the political ballyhoo goes on, unchecked and irrepressible.

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Britain Gets the Large Soviet Orders

While the United States was engaged in futile negotiations with Soviet Russia, resulting in an impasse that dissipated hopes of large metal-working machinery and equipment orders, Great Britain was getting a juicy slice of business involving more than £1,000,000 for machinery and equipment. Moreover, the contract was on a cash basis. It was announced on Jan. 28, by Arcos, according to Consul General Alfred Nutting, London. In addition to these orders, large purchases have also been made in Great Britain for re-export goods, mainly from the British Colonies and Dominions.

The Arcos orders involved £500,000 for railroad wheels, axles and tires complete, to be delivered in about six months. The fulfillment of this contract will require about 30,000 tons of British steel. Another order placed with British makers was for machinery and equipment for Soviet paper factories. It is the first time that such equipment has been ordered from England.

Other items ordered in January involved about 25,000 tons of different kinds of steel, to be delivered in about six months. The British non-ferrous metals industry received an order in January involving about £300,000. This was also placed on a cash basis.

A German concern in the Siegerland district has received an order for a rolling mill valued at RM.1,000,000 for installation in an iron and steel plant at Magnitogorsk in the eastern part of the Ural district, according to Vice Consul James H. Wright, Cologne. This order is of particular interest in view of the fact that Russian commitments in Germany have been less and less frequent during the past two years. Additional Russian business of substantial volume is said to be in the offing.

Large Industrial Construction Program Proposed by Michigan Representative

WASHINGTON, Feb. 26.—Preparatory to drafting legislation providing for a $970,000,000 industrial construction program without involving Federal aid, except in the way of insurance, Representative John D. Dingell of Michigan held a conference today with Jesse Jones, chairman of the Reconstruction Finance Corp., and Federal Housing Administrator James A. Moffett. The conference was the final of several Mr. Dingell has held with Administration officials and took place after he had submitted his plan to the President. The program is part of a move Mr. Dingell is making to revive private industry through new construction, purchase of machinery and repairs and improvements.

Two measures he has introduced have been offered as amendments to the National Housing Act. One provides for loans through national mortgage associations, each association being required to have a capital stock of par value not less than $2,000,000. The other provides for Government insurance up to 20 per cent of amounts on loans of not to exceed $50,000 to finance alterations, and repairs on apartments, hotels, office buildings and manufacturing plants, together with the installation of new permanent equipment and machinery. The present act limits such loans to $2,000. The amendment has been suggested by many industrialists as well as by the FHA.

Mr. Dingell also is seeking to overrule the Banking and Currency Committee and to provide Federal insurance of $3,000,000,000 in loans to industry which he predicts will put at least 3,000,000 men to work in the building trades alone. He considers as inadequate the measure of Chairman Steagall of the committee, which proposes to set aside $100,000,000 of funds previously set aside for FHA for improvements and new machinery in the types of structures mentioned.

The $970,000,000 construction program is based on replies to a questionnaire Mr. Dingell sent to 19,000 industrial concerns. Mr. Dingell said that they show that plans already have been drawn or are under consideration for new construction involving 11,587 projects. It was stated that 36 per cent could not be financed without Government-insured loans. The program was prepared with the aid of Albert H. Kahn, Inc., Detroit architect, and the summary of replies prepared by Moritz Kahn disclosed that 7645 firms wish loans of from $1,000 to $50,000; 1962 want to borrow $50,000 to $100,000; 1683 desire to borrow $100,000 to $500,000; 195 require $500,000 to $1,000,000, and 102 ask loans of more than $1,000,000.

In his report Mr. Kahn informed Representative Dingell that there are now waiting to be carried out in this country and within the near future new industrial plant modifications or expansions totaling approximately $970,000,000, exclusive of new equipment. Of this work Mr. Kahn said, 36 per cent, representing $349,200,000, can be started immediately, and the remaining 64 per cent depend upon a return of normal conditions. Of the total amount, it was stated, 62 per cent can be carried out by industrialists who are themselves able to finance the construction. The remaining 38 per cent, it was reported by Mr. Kahn, can be started only if financial aid is available, the reporting industrialists expressing preference for banking rather than Government aid, with long-term repayment periods.

In response to the request in the questionnaire for suggestions as to what the Government should do to alleviate present conditions, the following were included: Inspire confidence in the Government; stop Government interference with industry; eliminate Government competition with industry; stabilize the dollar; modify the collective bargaining section (7-a) of NRA; prevent adoption of the 30-hr. work week.

Mr. Dingell proposes that loans to industrialists, insured by the Government up to 20 per cent of their face value, be on a long term basis, not exceeding 20 years, and bearing interest at not exceeding 5 per cent, plus the premium charges for insurance of not less than one-half of 1 per cent and not more than 1 per cent. Mr. Dingell said the risk to the Government is practically nil and that the plan does not involve any expansion or inflation of the currency.

Congress to Be Given Chance to Draft Revised NRA Legislation

WASHINGTON, Feb. 26.—While the President's message to Congress last Wednesday proposed a two-year extension of the National Industrial Recovery Act and set forth only a broad outline for "suggested" legislation, more specific proposals, said to look to permanent NRA control of business, were sent under seal to Chairman Doughton of the House Committee on Ways and Means and Chairman Harrison of the Senate Committee on Finance.

Neither Representative Doughton nor Senator Harrison would disclose the contents of the Administration recommendations which they received from Donald R. Richberg, director of the National Emergency Council. They declared the Richberg letter was for their "personal guidance" and not for publication. The proposed NRA legislation has been referred to these two committees and they are charged with drafting the extension bill. The Administration heretofore has prepared its own bills. Therefore, its decision to leave to Congress the preparation of NRA legislation was a departure from customary practice. However, the more specific recommendations it made apparently were sent up as a chart to guide the drafting of the bill. At best the program is vague. This is due partially to the inability of the various Government branches, including numerous alphabetical agencies, to agree upon a definite plan.

Congress Belligerent

It is a question, however, whether the recommendations will be fully adopted. Congress is becoming increasingly belligerent in its attitude toward the Blue Eagle, and there is an element which would rejoice in its demise. There are others, a much larger section, which insist the act must be modified greatly, especially in the direction of preventing what its members call monopolistic practices and protecting what they call small enterprise.

The Administration message took notice of the necessity for fuller application of the fundamental principles of the anti-trust laws and said monopolies and private price fixing must not be condoned. The more detailed recommendations of the Administration, which remain to be officially made public, are said to propose a much broader overhauling of the Blue Eagle, giving it stronger talons, wings and beak. The view has become increasingly dominant that the old bird is pretty much of a sorry spectacle in its present plight.

However, the Administration made it clear that it does not propose a crack-down process by way of jailing violators. On the contrary, it is proposed that jail sentences be abolished in favor of fines, the latter to be increased from $500 to $1,000. Likewise cease and desist orders, such as those of the Federal Trade Commission, are in contemplation. The injunction process also is said to be under consideration as a means of expediting enforcement.

New Proposals

Other of the recommendations made by the Administration to the heads of the Ways and Means and the Finance Committees are said to include a provision authorizing the President to amend any code whenever he sees fit to do so. Remaining recommendations are apparently broadly outlined in the message, some of which are a part of the present law. They include definite minimum wages and maximum hours; imposition of a "limited" code where an industry is unable to agree upon voluntary submission of codes, with hours fixed at 30 to 40 per week, with time and one-half for overtime, a new proposal, and limitation in codes on price and production control, except to protect small enterprises and to restrain monopolies, also a new proposal.

The latter provision apparently is intended to appease cries in Congress against monopolistic practices and suppression of small enterprises they claim arise from code operation. It is also said to be proposed that existing codes be extended for 90 days beyond June 16, when the present act expires, in order to permit readjustments that codes will require on the basis of the new legislation.

Reaction Mixed

The proposal to make the code system permanent met with mixed reaction from industry. Supporters of the Administration often complain that industry is entirely too much inclined to want the benefits from code practice, such as the elimination of unfair trade practices, price cutting, etc., but often is decidedly loath to accept the burdens necessarily involved by Government supervision, labor relations, limitation of hours of work and payment of minimum wages.

The plan to make the code system permanent would, however, call for a change in the administrative machinery. The machinery in mind is a board drawn from public life with members of no partisan interest, but with wide experience in industrial and labor matters. The setting up of such a board, if it actually is ever set up, is a matter for the rather distant future.

The declaration by the President that the fundamental principles of the anti-trust laws should be more adequately applied and that monopolies and price fixing must not be condoned was taken to mean that more restriction may be thrown around these features. Protection against the chiseler also was implied as one purpose of the Administration. Mr. Richberg, at a press conference when he discussed highlights of the President's message, said that the greatest weapon of monopoly by which small enterprise has been crushed in the past has been price cutting. He declared that the message has left the doors wide open for Congress to make any changes it desires, including modification of Section 7-a (collective bargaining), which the President proposed be left unchanged. The message would do away with outright price fixing under codes, but would retain price provisions which in themselves would not constitute price fixing.

Hardly had the President's message been sent to Congress when the 30-hr. work week bill and the Wagner labor disputes bill bobbed up. The former was favorably reported by a subcommittee of the Senate Committee on Judiciary. The Wagner labor disputes bill was reintroduced on Thursday. Both measures obviously would entirely upset the proposed NRA program. Senator Wagner said the purpose of his bill was to clarify Section 7-a. Mr. Richberg expressed the opinion that Section 7-a is "perfectly sound and clearly stated." Mr. Richberg drafted the section.

The Administration also faces difficulty with its NRA program by reason of Congressional dissension and the mania for investigations which are multiplying until some of them overlap. A Senate judiciary subcommittee has ordered a broad investigation into so-called monopolies under NRA and an even wider inquiry asked by Senators Nye and McCarran has been approved by the Finance Committee, which will handle NRA legislation.

It is not known how these two investigations will be "coordi-

nated," if at all, but it is assumed the Finance Committee would not proceed with legislation until these inquisitions have been brought to an end. That indicates a long delay in passage of the new legislation.

On the House side, Representative Doughton said the Ways and Means Committee would consider the NRA legislation as soon as possible, but the economic security bill, now being considered, and bonus legislation will precede the NRA legislation. Mr. Doughton thought the latter might be reached in two or three weeks, a highly optimistic view in the opinion of some of his colleagues. He said the committee would prepare its own NRA bill and then hearings will begin.

Aluminum Code Again Extended — Other Code News

WASHINGTON, Feb. 26.— A 45-day extension of the aluminum industry's code and the proposal of amendments to require confidential reports to NRA of the prices and sales terms of all virgin aluminum ingot sold in this country by domestic producers and importers have been announced by the NIRB.

The board announced that suggestions or objections concerning the proposed amendments may be submitted within the next 20 days. The amendments were proposed by the board after consultation with a representative committee of the industry. The extension announced today is effective from Feb. 21 to midnight April 6. This is the third extension of the code which was approved June 26, 1934.

Air Valves: The NIRB has approved an amendment to the code of fair competition for the air valve industry, providing for a mandatory budget system. The amendment becomes effective March 11, unless good cause to the contrary is shown before that date.

Alloys Industry: The code authority for the alloys industry has made application for termination of the exemption in Administrative Order X-36, under which a business firm is exempt from contributing to expenses of any code administration except that covering its principal line of business.

Metal Hospital Furniture: The code authority for the metal hospital furniture manufacturing industry has made application for approval of its $7,200 budget, and the basis of contribution, for the period from Oct. 23, 1934, to June 16, 1935. The basis of contribution is 1/3 of 1 per cent of net sales for the budgetary period. The code authority has also asked for termination of the exemption granted in Administrative Order X-36.

Industrial Safety Equipment: The NIRB has approved an amendment to the code for the industrial safety equipment industry and industrial safety equipment trade, providing for an open price filing system with a waiting period of 48 hr. for filing higher prices.

Metal Tank: The code authority for the metal tank industry has made application for approval of a $17,925 budget to cover code administration expenses from Jan. 1 to June 16, 1935. The suggested basis of contribution is 3/8 of 1 per cent of the dollar volume of sales, payable monthly, and based on sales made during the preceding month.

Washing and Ironing Machine: The NIRB has approved the $7,515 budget for the period from Jan. 1, to June 16, 1935.

Fabricated Metal Products: The code authority for the fabricated metal products manufacturing and metal finishing and metal coating industry has applied for elimination of the exemption in paragraph 3 of Administrative Order X-36, under which a firm is exempted from contributing to the expenses of code administration except that covering its principal line of business.

Gas Cock: The gas cock industry's code authority has applied for approval of a $2,250 budget for the period Jan. 1, 1935, to June 30, 1935, and of a basis of contribution. The proposed basis of contribution is 0.35 of 1 per cent of total sales based on the first six months of 1934.

Packaging Machinery: The NIRB has approved amendments to the code for the packaging machinery industry and trade to clarify the definition of the industry and to add certain provisions to the articles relating to employment, wages, hours, state labor regulations and activities of the code authority. Included among the amendments are those providing for the safety and health of employees; against reclassification of workers to evade the purposes of the code; a handicapped workers' clause; and filing of statistics on hours and wages. The amendments also provide that no article of the code shall supersede any State regulation which imposes more stringent requirements as to employment conditions; that nothing in the code shall constitute the members of the code authority partners for any purpose; and that the NRA may suspend any action of the code authority if found to be against the public interest.

Steel Barrel and Drum: The standard steel barrel and drum manufacturing industry's code authority has submitted an application for an amendment to the supplementary code for the industry, a subdivision of the fabricated metal products and metal finishing and metal coating industry, providing for mandatory observance of price filing provisions of the code.

Railroad Car Building: A hearing will be held March 1 on a proposed amendment to the code for the railroad car building industry. The amendment would prohibit making allowances off the factory base price, except for specialties furnished by the customer; it would also require payment for all extra work necessitated by changes in specifications.

Code Authority Members Approved: The NRA has announced recognition of the following as duly elected members of code authorities:

Advertising Metal Sign and Display Manufacturing Industry: Charles R. Frederickson, American Art Works, Coshocton, Ohio; Leo M. Grace, Grace Sign Mfg. Co., St. Louis; Harry G. Evitt, Parker Metal Decorating Co., Baltimore; George H. Coulter, Massillon-Cleveland-Akron Sign Co., Massillon, Ohio; Merlin G. Robertson, W. F. Robertson Steel & Iron Co., Springfield, Ohio; Hermann Kemmel, Enameled Steel Sign Co., Chicago; and W. B. Cormany, Shonk works, American Can Co., Chicago.

Valve and Fitting Manufacturing Industry—Howard Coonley, Walworth Co., New York; Herbert C. Stockham, Stockham Pipe & Fitting Co., Birmingham; Charles R. Crane, Crane Co., Chicago; George M. Naylor, Fairbanks Co., New York; Frank A. Miller, Rensselaer Valve Co., Troy, N. Y.; Charles A. Brown, Lunkenheimer Co., Cincinnati; George C. Newbury, Jay H. Newbury & Son, Inc., Goshen, N. Y., and Roberts E. Bryant, Lockport Fittings Co., Lockport, N. Y.

Railroad Car Building Industry—J. F. MacEnulty, Pressed Steel Car Co., New York; L. N. Selig, General American Tank Car Corpn., Chicago; C. A. Liddle, Pullman-Standard Car Mfg. Co., Chicago; C. J. Hardy, American Car & Foundry Co., New York; R. K. Weber, Mount Vernon Car Mfg. Co., Mount Vernon, Ill.; F. L. Fay, Greenville Steel Car Co., Greenville, Pa.; and F. E. Symons, Ralston Steel Car Co., Columbus, Ohio.

Emery Criticizes New Wagner Proposal

WASHINGTON, Feb. 26.— The Wagner Labor Relations bill, introduced into Congress last week, was described by James A. Emery, general counsel of the National Association of Manufacturers, as an attempt to promote the "union-dominated company" under the guise of outlawing the "company-dominated union." He stated that "industry will seek in every way to awaken the country to the dangers of this renewed effort to regiment the nation's free workers into national unions which have already cost recovery such a heavy toll through violent strikes."

Mr. Emery also pointed out that Senator Wagner last year stated that his bill should be amended to outlaw coercion on the part of employee groups. "Unhappily," Mr. Emery added, "the Senator will not write his conviction into his proposal in the very words which he admits to be necessary and to which President Roosevelt has given his emphatic approval."

Mr. Emery said that under the stringent provisions of the measure it would be an unlawful act for an employer to discourage membership among his employees in a communist labor organization "or one which violated or did not keep its contracts, or has otherwise shown irresponsibility in conduct or leadership."

National Tube Sells Obsolete Plants

THE National Tube Co., Pittsburgh, has disposed of its Pittsburgh works, including the Pennsylvania and Republic departments, for dismantling by United Iron & Metal Co., Jay Stephens Corpn., and Charles Dreifus Co., all scrap brokers of Pittsburgh. The Pennsylvania department of the Pittsburgh works had an annual capacity of about 300,000 tons of 2 to 12-in. lap-weld pipe, while the Republic department, which was built in 1863, included a coupling finishing shop with capacity for threading and electro-galvanizing 8300 tons of seamless couplings annually. Both departments have been idle for many years.

United Gets Large Soviet Mill Order

THE Amtorg Trading Corpn. has awarded contract to the United Engineering & Foundry Co., Pittsburgh, for a complete Timken bearing-equipped, electrically-driven steel rolling mill, to be erected at the Zaporojstal Steel Works of the Soviet Union at a town of the same name. This order, amounting to more than $3,000,000, is reported to be one of the largest of its kind ever placed in the United States for foreign shipment. A portion of the mill will be built in the U.S.S.R. according to details, drawing and technical assistance to be furnished by the United Company.

The Zaporojstal plant is designed to have an annual capacity of 600,000 metric tons of hot and cold strip steel up to 60 in. wide for use in the rapidly expanding Soviet program. This mill will be similar in design to the one which United is now completing for the Ford Motor Co. plant at River Rouge, Mich. The United Company in a statement said:

"This mill will fit smoothly into the United production schedule and will be completed and shipped within 15 months. Ample facilities and equipment are available to handle this order and still enable the company to start work without delay on several other similar projects which are now contemplated in this country during 1935."

Mackintosh-Hemphill Gets J. & L. Mill

THE Jones & Laughlin Steel Corpn., Pittsburgh, has awarded contracts for blooming mill and equipment, to cost approximately $4,500,000, to four companies. The Mackintosh-Hemphill Co., Pittsburgh, will construct the mill, which is to be a 44-in., 2-high, reversing electrically driven blooming mill, with tables and other equipment. Electrical equipment will be furnished by the General Electric Co., while the cranes will be installed by the Morgan Engineering Co., Alliance, Ohio, and the Cleveland Crane & Engineering Co., Cleveland. Any new building construction will be done by the Jones & Laughlin company.

The new mill, which is only the second blooming mill that has been let since the Ford Motor Co. awarded a contract in 1928, is intended to improve the company's product and to replace existing equipment. It will not affect the number of men employed by the company. The mill will be erected at the company's South Side, Pittsburgh, works.

District Representatives of Ludlow-Saylor Wire Co.

ROBERT J. CARGO (at left) and William F. Boore, who, as noted in The Iron Age of Feb. 21, have been placed in charge, respectively, of the Pittsburgh and the Philadelphia offices of the Ludlow-Saylor Wire Co. of St. Louis.

Fabrication-in-Transit Rules Amended

REGULATIONS No. 9 of the steel code relating to plates, shapes and bars sold for fabrication for an identified structure were amended Feb. 14, to become effective March 1. Two concessions were made to protesting fabricators in the revised regulations. It is no longer required that the identical steel received from the mill be fabricated for the structure for which the material was purchased. If, after the material is received from the mill, equal quantities of the same kind of steel shipped from the same freight station are fabricated and shipped to the point of erection, the buyer will not forfeit his rights to any deductions that may be due him under fabrication-in-transit privileges.

The amended regulations also authorize allowances to fabricators for material wasted or scrapped which is not shipped from their plants to points of erection. Such deductions, however, are limited to 6 per cent of the total quantity of steel sold for a given project.

Another new feature of the amended instrument is a provision that, when material is shipped by a truck provided by the purchaser, freight deductions shall not exceed 65 per cent of the all-rail carload freight charges that would otherwise be applicable, or, at a basing point, 65 per cent of the existing switching arbitrary. Special treatment is provided for the City of New York, where, if both the place of fabrication and the point of delivery are within the municipal limits, the allowance is limited to $1 a ton.

The amended regulations go into effect on March 1, except on sales made on or before March 31, in accordance with written quotations outstanding Feb. 28.

Small independent fabricators view the amended regulations with some disfavor, and point out that they afford little, if any, of the relief from the original regulations which they desired. They insist that the regulations provide that any benefits to be derived from reduced transportation charges accrue only to the mills. They also maintain that their ability to seek business in competitive territory not adjacent to their shops is now limited entirely to the discretion of mills in absorbing freight charges, which they may do under the iron and steel code by quoting on different bases. It is likely, however, that the regulations will not be officially protested by any organized group of fabricators.

Monthly Report of Metal Working Activity

These Data Are Assembled By THE IRON AGE From Recognized Sources And Are Changed Regularly As More Recent Figures Are Made Available. Boldface Type Indicates Changes This Week

	January, 1935	December, 1934	January, 1934	1935 to Date	Year 1934
Raw Materials:					
Lake ore movement (gross tons) [a]	.....	.....	.....	.....	22,249,600
Coke production (net tons) [b]	**2,889,552**	2,501,441	2,583,685	2,889,552	31,830,210
Pig Iron:					
Pig iron output—monthly (gross tons) [c]	1,477,336	1,027,622	1,215,226	1,477,336	15,911,188
Pig iron output—daily (gross tons) [c]	47,656	33,149	39,201	47,656	43,592
Castings:					
Malleable castings—production (net tons) [d]	.....	32,746	30,417	.....	369,458
Malleable castings—orders (net tons) [d]	.....	36,505	32,501	.....	354,146
Steel castings—production (net tons) [d]	.....	23,916	27,644	.....	450,087
Steel castings—orders (net tons) [d]	.....	27,312	26,296	.....	434,131
Steel Ingots:					
Steel ingot production—monthly (gross tons) [e]	2,834,170	1,941,595	1,971,187	2,834,170	25,263,569
Steel ingot production—daily (gross tons) [e]	104,969	77,664	73,007	104,969	81,233
Steel ingot production—per cent of capacity [e]	47.67	35.27	33.16	47.67	36.89
Employment in Steel Industry:					
Total employees [e]	.....	386,345	393,013	.....	409,348
Total payrolls [e]	.....	$35,362,732	$34,877,542	.....	$457,842,517
Average hours worked per week [e]	.....	28.4	30.3	.....	30.5
Finished Steel:					
Trackwork shipments (net tons) [e]	2,333	2,272	2,811	2,333	49,110
Sheet steel sales—(net tons) [f]	**321,831**	193,130	209,463	321,831	1,830,682
Sheet steel production (net tons) [f]	**235,714**	159,740	163,622	235,714	1,895,460
Fabricated shape orders (net tons) [g]	***55,857**	67,799	91,594	*55,857	1,054,382
Fabricated shape shipments (net tons) [g]	***85,950**	88,687	57,623	*85,950	1,116,222
Fabricated plate orders (net tons) [d]	.....	26,025	15,897	.....	241,992
Reinforcing bar awards (net tons) [e]	15,600	7,650	17,800	15,600	177,350
U. S. Steel Corpn. shipments (tons) [h]	534,055	418,630	331,777	534,055	5,925,873
Fabricated Products:					
Automobile production U. S. and Canada [d]	.....	185,919	163,811	.....	2,895,629
Construction contracts (37 Eastern States) [i]	$99,773,900	$92,684,900	$186,463,700	$99,773,900	$1,543,102,300
Steel barrel shipments (number) [d]	.....	424,233	206,347	.....	6,682,400
Steel furniture shipments [d]	.....	$1,090,171	$996,838	.....	$11,807,843
Steel boiler orders (sq. ft.) [d]	.....	259,875	235,776	.....	4,368,563
Locomotive orders (number) [k]	0	0	0	0	183
Freight car orders (number) [k]	24	360	150	24	24,611
Machine tool index [l]	65.5	66.1	53.7	65.5	46.2
Foreign Trade:					
Imports of pig iron (gross tons) [m]	.....	3,642	11,886	.....	115,470
Imports of rolled steel (gross tons) [m]	.....	6,274	7,183	.....	100,562
Exports of all steel (gross tons) [m]	.....	85,013	89,798	.....	997,210
Exports, finished steel (gross tons) [m]	.....	78,137	78,818	.....	833,559
Exports of scrap (gross tons) [m]	.....	196,361	87,272	.....	1,835,554
British Production:					
British pig iron production (gross tons) [n]	521,200	513,500	441,300	521,200	5,978,500
British steel ingot production (gross tons) [n]	757,800	654,500	711,000	757,800	8,860,700

* Preliminary.

Sources of figures: [a] Lake Superior Iron Ore Association; [b] Bureau of Mines; [c] THE IRON AGE; [d] Bureau of the Census; [e] American Iron and Steel Institute; [f] National Association of Flat-Rolled Steel Manufacturers; [g] American Institute of Steel Construction; [h] United States Steel Corpn.; [i] F. W. Dodge Corpn.; [k] *Railway Age*; [l] National Machine Tool Builders Association; [m] Department of Commerce; [n] British Iron and Steel Federation.

Weekly Indications of Steel Activity

From THE IRON AGE

	Feb. 26, 1935	Feb. 19, 1935	Jan. 29, 1935	Feb. 27, 1934	Average, Year to Date 1935	Average, Year to Date 1934
Steel ingot operations—Per cent of capacity	**48.5**	50.5	56.0	47.0	50.5	**37.0**

	Week Ended Feb. 26, 1935	Week Ended Feb. 19, 1935	Week Ended Jan. 29, 1935	Week Ended Feb. 27, 1934	Year to Date 1935	Year to Date 1934
Fabricated structural steel awards	**6,700**	13,250	5,250	6,700	102,065	122,815
Fabricated plate awards	**1,460**	700	1,185	620	15,230	6,915
Sheet steel piling awards	**0**	0	0	0	2,400	13,065
Reinforcing bar awards	**5,000**	12,800	9,050	3,425	37,865	35,425

Downward Trend of Steel Output Not Yet Checked

Ingot Rate Recedes Two Points Lower to 48½ Per Cent—Scrap Also Gives Further Ground—Steel Prices Reaffirmed for Next Quarter

STEEL production and scrap prices have suffered further declines. Ingot output has receded in most of the important producing centers, and the national average has dropped two points to 48½ per cent of capacity. Notable exceptions to the general trend are Chicago and Detroit, where operations have held at 54 and 100 per cent respectively, and Birmingham, where an accumulation of rail orders has lifted the district rate from 50 to 54 per cent.

Weakness in scrap prices is country-wide and recessions in heavy melting steel at Pittsburgh and Chicago have depressed THE IRON AGE scrap composite from $11.92 to $11.67 a ton. The improvement in sentiment that followed the gold clause decision was short-lived. Continued curtailment of steel works consumption of scrap has been accompanied by an increased use of hot metal in keeping with the desire of producers to utilize the output of recently lighted blast furnaces. Meanwhile the production of industrial scrap has been mounting. At Detroit, docks and yards are loaded with old material, and the flow of scrap from the West and Southwest is swelling.

IT is still a moot question whether consumption of finished steel has suffered a setback. The automotive industry has by no means abandoned its plans for continued heavy production, and container manufacturers and farm equipment makers remain active users of mill products. It is undoubtedly a fact that, except for sheets and possibly strip steel and alloy steel bars, the automobile makers are temporarily well stocked with steel. They have also probably built up a comfortable inventory of finished cars. But the importance of stock accumulations may be easily overemphasized in view of difficulties that have been encountered in production coordination now that a high rate of output has been attained. In a number of cases automobile companies have been handicapped because deliveries of bodies and other parts have fallen behind assembly schedules. In another instance shipments of running boards—and incidentally of the sheets used to construct them—have been held up because of a strike. Despite these hindrances February assemblies of the industry are estimated to have reached 360,000 units, and this total is expected to be raised to 400,000 in March.

As for April, motor car makers have sent mills large orders for sheets for that delivery and these will be entered on March 1 when second quarter books are opened.

OTHER steel consumers are in no haste to get protection for next quarter. The spirits of the trade have ebbed with the recession in steel works activity and long-term undertakings are again being delayed. The growing belligerency of Congress and the reintroduction of the highly controversial Wagner labor bill are among developments in the national political scene which are now disturbing business.

Construction work is still hampered by the weather. Structural steel awards total only 6700 tons compared with 13,500 tons a week ago. New projects call for 8500 tons. The General Petroleum Corpn., Los Angeles, will close soon on 8000 tons of seamless steel pipe for an 88-mile oil line. Chicago will take bids March 5 on 3200 tons of cast iron pipe.

The Bangor & Aroostook has ordered 1000 tons of rails and the Chicago Great Western has applied for Government funds to buy 5000 tons. The Burlington has placed 7000 tons of track fastenings. The Missouri Pacific has been granted authority by the Federal court to spend $1,405,000 for rails and fastenings.

A resolution has been adopted by the steel code authority permitting the shipment of rails and track supplies until Oct. 1 on sales made prior to June 1. Regulation No. 9, covering structural material fabricated in transit, has been amended to meet some of the objections of fabricators.

STEEL ingot output is off two points to 37 per cent at Pittsburgh, one point to 35 per cent in the Philadelphia district, seven points to 53 per cent in the Valleys, four points to 63 per cent in the Cleveland area, five points to 41 per cent at Buffalo and five points to 80 per cent in the Wheeling district.

THE IRON AGE composite prices for pig iron and finished steel are unchanged at $17.90 a ton and 2.124c. a lb. respectively. The reaffirmation of present prices for second quarter did not come as a surprise. The opening of books on March 1 is not expected to stimulate buying except in sheets and, to a more limited extent, in alloy steel bars.

A Comparison of Prices

Market Prices at Date, and One Week, One Month, and One Year Previous
Advances Over Past Week in Heavy Type, Declines in Italics

Pig Iron

	Feb. 26, 1935	Feb. 19, 1935	Jan. 29, 1935	Feb. 27, 1934
Per Gross Ton:				
No. 2 fdy., Philadelphia	$20.26	$20.26	$20.26	$19.26
No. 2, Valley furnace	18.50	18.50	18.50	17.50
No. 2 Southern, Cin'ti	19.13	19.13	19.13	18.13
No. 2, Birmingham†	14.50	14.50	14.50	13.50
No. 2 foundry, Chicago*	18.50	18.50	18.50	17.50
Basic, del'd eastern Pa.	19.76	19.76	19.76	18.76
Basic, Valley furnace	18.00	18.00	18.00	17.00
Valley Bessemer, del'd P'gh	20.76	20.76	20.76	19.76
Malleable, Chicago*	18.50	18.50	18.50	17.50
Malleable, Valley	18.50	18.50	18.50	17.50
L. S. charcoal, Chicago	24.04	24.04	24.04	23.54
Ferromanganese, seab'd carlots	85.00	85.00	85.00	85.00

†This quotation is for delivery in South; in the North prices are 38c. a ton under delivered quotations from nearest Northern furnace.

*The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Rails, Billets, etc.

Per Gross Ton:				
Rails, heavy, at mill	$36.37½	$36.37½	$36.37½	$36.37½
Light rails, Pittsburgh	35.00	35.00	35.00	32.00
Rerolling billets, Pittsburgh	27.00	27.00	27.00	26.00
Sheet bars, Pittsburgh	28.00	28.00	28.00	26.00
Slabs, Pittsburgh	27.00	27.00	27.00	26.00
Forging billets, Pittsburgh	32.00	32.00	32.00	31.00
Wire rods, Pittsburgh	38.00	38.00	38.00	36.00
	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb.	1.70	1.70	1.70	1.60

Finished Steel

Per Lb.:	Cents	Cents	Cents	Cents
Bars, Pittsburgh	1.80	1.80	1.80	1.75
Bars, Chicago	1.85	1.85	1.85	1.80
Bars, Cleveland	1.85	1.85	1.85	1.80
Bars, New York	2.13	2.13	2.13	2.08
Plates, Pittsburgh	1.80	1.80	1.80	1.70
Plates, Chicago	1.85	1.85	1.85	1.75
Plates, New York	2.08	2.08	2.08	1.98
Structural shapes, Pittsburgh	1.80	1.80	1.80	1.70
Structural shapes, Chicago	1.85	1.85	1.85	1.75
Structural shapes, New York	2.05¼	2.05¼	2.05¼	1.95¼
Cold-finished bars, Pittsburgh	2.10	2.10	2.10	2.10
Hot-rolled strips, Pittsburgh	1.85	1.85	1.85	1.75
Cold-rolled strips, Pittsburgh	2.60	2.60	2.60	2.40

Finished Steel

	Feb. 26, 1935	Feb. 19, 1935	Jan. 29, 1935	Feb. 27, 1934
Per Lb.:	Cents	Cents	Cents	Cents
Hot-rolled annealed sheets, No. 24, Pittsburgh	2.40	2.40	2.40	2.25
Hot-rolled annealed sheets, No. 24, Gary	2.50	2.50	2.50	2.35
Sheets, galv., No. 24, P'gh	3.10	3.10	3.10	2.85
Sheets, galv., No. 24, Gary	3.20	3.20	3.20	2.95
Hot-rolled sheets, No. 10, P'gh	1.85	1.85	1.85	1.75
Hot-rolled sheets, No. 10, Gary	1.95	1.95	1.95	1.85
Wire nails, Pittsburgh	2.60	2.60	2.60	2.35
Wire nails, Chicago dist. mill	2.65	2.65	2.65	2.40
Plain wire, Pittsburgh	2.30	2.30	2.30	2.20
Plain wire, Chicago dist. mill	2.35	2.35	2.35	2.25
Barbed wire, galv., P'gh	3.00	3.00	3.00	2.85
Barbed wire, galv., Chicago dist. mill	3.05	3.05	3.05	2.90
Tin plate, 100 lb. box, P'gh	$5.25	$5.25	$5.25	$5.25

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	$12.75	$13.00	$13.25	$14.75
Heavy melting steel, Phila	11.50	11.50	11.75	11.75
Heavy melting steel, Ch'go	10.75	11.25	11.50	11.75
Carwheels, Chicago	12.00	12.00	12.00	11.75
Carwheels, Philadelphia	12.50	12.50	10.75	12.75
No. 1 cast, Pittsburgh	13.25	13.75	13.75	13.25
No. 1 cast, Philadelphia	11.00	11.00	11.00	12.50
No. 1 cast, Ch'go (net ton)	10.00	10.00	10.00	9.50
No. 1 RR. wrot., Phila	11.00	11.00	11.25	11.00
No. 1 RR. wrot., Ch'go (net)	8.75	9.25	10.50	9.50

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	$3.85	$3.85	$3.85	$3.50
Foundry coke, prompt	4.60	4.60	4.60	4.25

Metals

Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Electrolytic copper, refinery‡	8.75	8.75	8.75	7.75
Lake copper, New York‡	9.12½	9.12½	9.12½	8.00
Tin (Straits), New York	47.87½	50.35	50.95	52.15
Zinc, East St. Louis	3.75	3.70	3.70	4.40
Zinc, New York	4.10	4.05	4.05	4.75
Lead, St. Louis	3.40	3.40	3.55	3.90
Lead, New York	3.55	3.55	3.70	4.00
Antimony (Asiatic), N. Y.	14.50	14.50	14.50	7.20

On export business there are frequent variations from the above prices. Also, in domestic business, there is at times a range of prices on various products, as shown in our detailed price table. ‡Blue Eagle copper.

The Iron Age Composite Prices

	Finished Steel	Pig Iron	Steel Scrap
Feb. 26, 1935	2.124c. a Lb.	$17.90 a Gross Ton	$11.67 a Gross Ton
One week ago	2.124c.	17.90	11.92
One month ago	2.124c.	17.90	12.17
One year ago	2.008c.	16.90	12.75
	Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strips. These products make 85 per cent of the United States output.	Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Birmingham.	Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

	Finished Steel High	Finished Steel Low	Pig Iron High	Pig Iron Low	Steel Scrap High	Steel Scrap Low
1934	2.199c., April 24	2.008c., Jan. 2	$17.90, May 1	$16.90, Jan. 27	$13.00, Mar. 13	$9.50, Sept. 25
1933	2.015c., Oct. 3	1.867c., April 18	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.977c., Oct. 4	1.926c., Feb. 2	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.42, July 5
1931	2.037c., Jan. 13	1.945c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.273c., Jan. 7	2.018c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.317c., April 2	2.273c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1928	2.266c., Dec. 11	2.217c., July 17	18.59, Nov. 27	17.04, July 24	16.50, Dec. 31	13.08, July 2
1927	2.402c., Jan. 4	2.212c., Nov. 1	19.71, Jan. 4	17.54, Nov. 1	15.25, Jan. 11	13.08, Nov. 22

Further Dip to 37 Per Cent In Operations at Pittsburgh

Valley Output Is Down Seven Points to 53 Per Cent and Wheeling Rate Falls to 80 Per Cent—Scrap Again Declines

PITTSBURGH, Feb. 26.—New demand for most grades of finished steel is ebbing. Notable exceptions are strip steel and tin plate. The narrowing of consumer interest is observed largely in the automotive industry, which temporarily seems to be well stocked with steel. Demand from miscellaneous consumers, however, appears to be sustained and shipments in this case have not fallen off materially.

Steel producers, on the other hand, are keeping a more sensitive finger on the pulse of consumer demand and current operations are now in better balance with the flow of finished steel. In the Pittsburgh area, ingot output has dropped two points this week to 37 per cent, the third consecutive weekly decline. A similar trend is reported in the Valleys and nearby northern Ohio mills, where operations have dropped seven points to 53 per cent, and in the Wheeling district, which is down five points to 80 per cent.

Finishing mill schedules are substantially unchanged. Sheet mills and tin plate mills are operating at a strong 70 per cent, while strip steel units are sustained at 65 per cent.

There is a strong belief that the downtrend in raw steel production will be checked before the end of the first quarter. Further buying on a broad scale for second quarter delivery is expected from the automotive industry, which shows no evidence of forsaking its ambitious plans for continued heavy production. Seasonal activity in the spring should open up a heavier demand for constructional steel, which has been badly affected by severe winter conditions. The hope for large-scale purchases by the railroads appears to be waning, principally in view of a reversal of the Federal attitude regarding financing.

The present quieter mood in the steel industry is taken as an indication of a growing desire on the part of general business for a clearer analysis of the national political puzzle, with particular emphasis on proposed labor legislation.

Pig Iron

Although bookings this month probably will slightly exceed those in January, the trend in demand appears to be downward. Prospects for improvement either late in first quarter or early in the coming period are considered good, since some larger consumers may be forced to replenish on a moderate scale. How much of this prospective business will reach merchant furnaces is conjectural in the face of the many reciprocal arrangements now ruling. A wrought iron pipe manufacturer is expected to be in the market soon. The movement of charcoal iron to roll makers is heavier.

The granting of a Federal loan to the Struthers Iron & Steel Co. may result in the resumption of operations of the company's blast furnace at Struthers, Ohio, which has an annual capacity of 180,000 tons of foundry, basic and malleable.

All producers in the Pittsburgh and Valley districts will open their books on March 1, for second quarter tonnage, with current prices extended until June 30.

Semi-Finished Steel

Although non-integrated mill demand for sheet bars in some directions has diminished, the aggregate volume has not suffered materially. With some detached sheet mills and tin plate units still operating at virtual capacity, semi-finished steel stocks have not been increased to any extent this quarter. Slabs and billets are holding their own, while forging stock still enjoys steady demand. Skelp is fairly active. All current semi-finished steel prices will be formally quotable on March 1, on second quarter business.

Bolts, Nuts and Rivets

Minor improvement in demand continues, but the market, as a whole, is far from active. Although no changes in current discounts are expected to be made for second quarter, definite announcement of prices has not yet been made.

Rails and Track Accessories

Although a fairly substantial tonnage of rails and track accessories pends, new inquiry reaching this district is unusually light. The local rail mill still has a fair backlog, and this week will roll a small tonnage. Track bolts for quoting to steam railroads will be reaffirmed for second quarter at $3.55, base per 100 lb.; spikes at $2.40, and tie plates at $1.90.

Reinforcing Steel

Activity still is depressed by severe weather. Public works projects still comprise the main outlet for new business. Two additional dams for the Muskingum Water Shed Conservancy district probably will be figured in March. A total of 15 dams is specified for the Muskingum project. On March 19, bids will be opened on the Mohawk dam near Warsaw, Ohio, which will require about 700 tons of reinforcing steel. New billet steel reinforcing in straight lengths as quoted by distributers will be reaffirmed at 2.05c. a lb., Pittsburgh, for second quarter shipment.

Cold-Finished Bars

A slight decline in fresh specifications is believed to reflect a fairly well stocked position of the automotive industry. As soon as current inventories are worked off, however, demand from the automotive industry is expected again to be resumed on a large scale. Specifications from agricultural implement makers, while not unusually heavy in volume, are being received more regularly than has been the case in several years. The reaffirmation of the current Pittsburgh base of 2.10c. a lb. for second quarter shipment, for quoting on March 1, will tend to keep jobber replenishment on a restricted basis. Miscellaneous bookings are reported to be well sustained.

Bars

Orders are appearing less frequently from the automotive industry, and bar mill rolling has been further retarded. The ambitious schedules of motor car makers, however, portend a sustained demand for steel as soon as present stocks are whittled down. A fair demand continues from farm implement makers, while miscellaneous business is possibly a shade lighter. Soft steel bars will be reaffirmed on March 1, at 1.80c., base per lb., Pittsburgh, for second quarter shipment.

Plates and Shapes

Mill prices for plain material will be reaffirmed on March 1, for

second quarter shipment. Although a fairly substantial tonnage of plates has been figured for barge construction in recent weeks, bookings reaching this district have remained disappointingly small. Demand for railroad construction and tank work shows little improvement. Reports of fresh awards in this district indicate that the structural steel market has not shaken off its recent lethargy. Lettings continue to be unimportant both in tonnage and number. Featuring the list of new projects now being figured is 1400 tons for a Tennessee Valley Authority bridge at New Tazewell, Tenn.

Wire

Demand has made little headway in the past week. Shipments of manufacturers' wire to the automotive industry are slightly less frequent. Merchant items are moving a little faster, but the jobbing trade generally is not inclined to build up heavy stocks in anticipation of spring activity. Early requirements of agricultural districts have not yet appeared in this district. Wire fencing is benefiting sporadically by public works projects, while wire mesh for road construction finds its chief outlet in the South and Southwest. All present quotations on wire products will be reaffirmed for second quarter.

Tubular Products

The General Petroleum Corpn., Los Angeles, a subsidiary of the Socony Vacuum Oil Co., Inc., is expected to close this week on about 8000 tons of 10¾ in. o.d. seamless pipe for an 88-mile oil line in California. Since seamless tubing is specified, the tonnage, if placed, should benefit the Pittsburgh-Youngstown district. In other directions the oil industry also is responsible for the bulk of demand in this market.

The movement of mechanical tubing to motor car centers has declined slightly, but not sufficiently to affect tube mill schedules. Carlot buying continues to characterize activity in stationary boiler tubes and locomotive boiler tubing. All current discounts covering tubular products are being extended through second quarter.

Sheets

Specifications declined materially in the past week, with the sharpest drop recorded in automotive tonnage. Miscellaneous demand, however, has not shrunk so sharply as that from motor car centers. Calls from the metal furniture industry are unusually encouraging, while interest from the farm implement makers is well sustained. Cold-finished sheet units generally are booked at capacity through March, and the drop in automotive demand may be laid partly to the inability of these mills to accept additional tonnage. Sheet mill output this week probably will average 70 per cent of capacity.

Tin Plate

A slightly heavier flow of specifications is reported, and at least two mills have stepped up production this week. Activity at some small independent mills, however, is not so brisk, and average operations for the tin plate industry will probably be a strong 70 per cent this week. The bulk of current rolling is reported to be against actual specifications, although prompt shipment is not being made in all instances.

Strip Steel

Demand for hot and cold-rolled strip has not suffered the set-back reported in other steel products moving to the automotive industry. Demand is well supported by a regular flow of miscellaneous business, although specifications for farm implement manufacture have not yet met expectations. Some strip units are sold up until the end of first quarter, while others are booked fully a fortnight ahead. Operations this week likely will be sustained at 65 per cent of capacity. Hot and cold-rolled strip will be reaffirmed at present bases for second quarter shipment.

Coal and Coke

A fair amount of stocking of bituminous coal continues, principally by some of the carriers. Such coverage is believed to be in anticipation of any difficulties that might arise in the mine labor arrangements beginning April 1. At present, however, it seems unlikely that any major difficulties will be encountered, but some fuel interests in this district suggest the possibility of higher coal prices for the coming "coal" year. The domestic coke market has received a fillip from the severe storms in the past week. Foundry and furnace coke, however, are extremely sluggish. The Chateaugay Iron Ore Co., Standish, N. Y., covered earlier in the month on its requirements of furnace coke, which it purchased in the Connellsville region.

Scrap

The strong sentiment that followed announcement of the gold clause decision last week was short-lived. Prices have weakened, notably on production grades of scrap, while heavy melting steel is off 25c. a ton. Mill suspensions now are the general rule and rejections appear to be increasing. One mill in this district last week purchased about 5000 tons. Reasons for the soft turn in the market are varied. The majority of raw steel production in recent months has gone into the lighter finished steel grades and output of industrial scrap consequently has been increasing. More liberal scrap supplies are appearing from industrial regions in the West and Southwest. Cast grades have weakened in sympathy with the general trend.

St. Louis Mills Show Gain in Bookings

ST. LOUIS, Feb. 26.—Sales of the Granite City Steel Co. continue at a high rate, bookings in the first seven weeks in 1935 having been 85 per cent ahead of the same period last year. While the improvement has extended to all lines, the heavier products have not shown the same gains as the light products, such as galvanized sheets, hot-rolled annealed, tin mill black and tin plate. Tin plate leads, there having been heavy commitments within the last two or three weeks. Takings of steel by jobbers are increasing markedly, although not for speculation but rather for immediate needs.

The Missouri Pacific Railroad has been authorized by the Federal Court here to expend $5,584,603 for improvements during 1935, of which $1,405,250 is for rails and other track material.

The melt and deliveries of pig iron in January reached the highest totals since last summer, and the average daily rate during the first half of February was slightly above that for the whole month of January, the Federal Reserve Bank reports. One factor reports that its sales of pig iron in December were the heaviest for that month in 20 years and in January the heaviest in four years. Prices of pig iron prevailing in the first quarter have been reaffirmed for second quarter.

The scrap market is weak and the tendency is toward lower prices. Selected heavy steel is 25c. a ton lower, while other items are nominally unchanged, there having been no trading upon which to establish a market. Mills in this district are not buying and weakness in other centers is preventing shipments of materials from here.

Steel Output Holds at 54 Per Cent in Chicago Area

Buying Appears to Be in Sufficient Volume to Forestall Further Recessions in Operations—Steel Scrap Is Off 50c

CHICAGO, Feb. 26. — Ingot output has leveled off at 54 per cent of capacity and new specifications are in such volume as to indicate that the current rate will hold. New buying has been dragging, but this is not surprising, because most consumers have already covered requirements for next month and books will not be opened for the second quarter until March 1.

Most producers have now filed prices, and from all available information at this time first quarter schedules will be carried forward unchanged for deliveries to be made in the second quarter.

The scrap market, still being speculative in character, is following an erratic course. Pressure buying is severe, which, added to the increased make of steel mill pig iron and the comparatively free flow of scrap, is forcing prices down. Steel mill grades are off 50c. a ton and the price structure is still wabbly.

Railroad business in the West is largely limited to track accessory orders. About 7000 tons was ordered by the Burlington. Prospects for added rail tonnages are none too bright. Several railroads, among them the Chicago Great Western and the Chicago & North Western, are faced with early bond interest dates.

Orders for tin plate are steady and the season is near at hand when this commodity should, and from all indications will, move much faster. The agricultural situation is clouded by dust storms in western Kansas and adjacent areas, but in the upper Mississippi River and Missouri River valleys heavy snows are falling.

Pig Iron

Price schedules will remain unchanged for the second quarter. February shipments of pig iron top the total for January, despite the shorter month. There is every indication that foundry melt is slowly creeping upward.

Coke

Current prices are being carried forward for deliveries to be made in March. Total shipments in February exceeded those of January.

Reinforcing Bars

Awards in the immediate area of Chicago are small, consisting mainly of outlying post offices. The State of Illinois has closed bids on 1000 tons of paving work and a 2000-ton sewer project is announced at Minneapolis. Prices are unchanged, there is much discussion concerning circumstances wherein both structural steel and reinforcing bars are furnished by one bidder. Bar fabricators, who can furnish only the bar requirements, are opposing the joint bid practice.

Cast Iron Pipe

Chicago will take bids March 5 for 3200 tons of 20 to 54-in. pipe. Inquiries are scarce, though a slow general improvement has been noted during the past two weeks. Prices remain firm and opinion leans to the view that current prices will be reaffirmed for the second quarter.

Wire Products

Production remains at 55 per cent of capacity. Releases are variable, but average about the same at the end of each week. In fact, the total movement in February will closely approximate shipments in January. The use of nails is slowly expanding and shipments of wire and wire products to South American countries are at a better level. There is no lessening in the pressure of imports, which have had some bearing on the closing of a number of Southern mills. The tonnage coming in is not so large, but the prices at which the material is selling affect not only territories where foreign goods are sold, but also adjoining areas. Industrial consumers, though not increasing their needs, are not reducing their specifications.

Sheets

Books will be opened Friday with all current quotations extended for deliveries in the second quarter. Sellers believe that order-taking will be brisk, particularly for the reason that among all steel mill products sheets have been the most difficult to handle with respect to matching deliveries with production schedules. Several automobile body plants are reported to be falling behind the schedules for assembly lines.

Rails

This market continues to move in a fog, and the best that sellers can ascertain at this time is that most tonnages will not be ordered until needed and that those tonnages will be of limited size. The Burlington has ordered 7000 tons of track fastenings. One Chicago rail mill may go on a limited schedule in a week or ten days.

Structural Material

Awards are very light and one must turn to fresh inquiries to find encouragement. Plans will soon be out on the Mississippi River dam at Alton, Ill. This project will take 6000 tons of structural steel. Shops also expect to enter bids on about 2500 tons for the Ashland Avenue, Chicago, bridge.

Plates

Demand in the immediate vicinity of Chicago remains slow except for the possibility that the Burlington will go ahead with its program to build 500 freight cars in its own shops. Incidentally it should be noted that this program at first called for 900 cars, but the number is now set at 500 units. About 400 tons of plates will be used for a syphon on the Platte River, Neb., irrigation project. Shawano, Wis., has ordered tanks requiring 375 tons.

The drop in demand for this commodity has been checked, and this week production will hold at the low established a week ago. Automobile assembly lines have not, in all cases, been receiving bodies as fast as needed, and that situation accounts for most of the curtailment of bar shipments. Miscellaneous demand has changed little in recent weeks, and farm equipment manufacturers are finding no reason to lower production schedules.

Scrap

A local steel mill has taken about 10,000 tons of heavy melting steel at $11 a gross ton, delivered, which is 50c. a ton under the prices established by sales a week ago. Curtailment of ingot output and the desire of mills to keep all blast furnaces lighted have been working against the scrap price structure. Also, there has been considerable pressure because of tonnages arriving on track that were not easily placed for unloading at consumers' yards. Lower prices will tend to check the flow from outlying points.

Iron and Steel Trade Is Quiet at New York

Demand Is Slackening and February Steel Bookings Will Show a Sizable Loss Compared With January

NEW YORK, Feb. 26. — If any one should ask the state of sentiment in the local iron and steel market, the answer would have to be that there isn't any sentiment. The recent setback suffered by steel output and the uncertainties created by Congressional attacks on bigness in business have left the trade agape. Despite the sold-up condition of cold-finished sheet mills and the pressure of automobile makers to get "reservations" on producers' books for second quarter, buyers in this district are in no haste to cover their needs for either nearby or forward delivery.

February bookings of local mills' offices, according to late reckonings, will fall short of January commitments by all the way from 15 to 30 per cent. Some sellers report a sustained flow of tin plate releases, but others have experienced a decline in volume. Sheet and pipe specifications as yet show no seasonal upturn, and business in heavy rolled products remains irregular and dependent on occasional large construction awards or railroad orders. Railroad buying is still conspicuous because of the slowness with which it is developing. A resolution adopted by the American Iron and Steel Institute permits the shipment of rails, splices, spikes and tie plates until Oct. 1 on sales to railroads and frog and switch makers prior to June 1.

Oakdale Contracting Co., New York, is low bidder on the general contract for a 48-in. steel pipe line for a municipal water project in the Bronx. About 850 tons of plates will be required.

Pig Iron

Only 1150 tons of fresh business came into this market during the past seven-day period, as compared with 2450 tons a week earlier and 1500 tons booked a fortnight ago. All second quarter prices are filed and, as expected by the trade, they are unchanged. Most sellers are looking forward to a fair amount of contracting after the end of the month, but this attitude is mainly fostered by hope. On the other hand, all the conditions which tend to discourage forward purchasing are still in effect, namely, a continued poor outlook for foundry activity, general business uncertainty, and full protection against a price rise.

Reinforcing Steel

Well over 1000 tons of bars is still active in this area, but repeated delays by general contractors are keeping these orders from distributers. Sellers are hoping that some of this tonnage will be let before the end of the week. The only significant award was to a local warehouse and involved 220 tons of bars for a railroad depression project at New York. Wire mesh sellers are still in the midst of an extremely inactive period. When weather conditions improve sufficiently to encourage outdoor construction, both the mesh and bar sellers believe their respective businesses will show considerable improvement.

Scrap

The volume of new export business in this area has led to the belief that advanced prices might prevail in the near future. However, the general inactivity and softer undertone of the entire domestic market is beginning to be felt; foreign buyers are attempting to drive harder bargains, and at the present time there are evidences that local brokers may soon reduce their buying prices in order to meet these lower selling bids. Otherwise there is little change in conditions here. Steels and small tonnages of cast, stove plate, and specialty grades are being loaded daily for shipment abroad. There is practically no tonnage moving from northern Jersey into domestic consumption. Italy's purchases of American scrap totaled 35,000 tons in January, as compared with total purchases of 52,000 tons. Total foreign scrap shipments in 1934 amounted to 1,835,554 tons, 27 per cent of which moved from New York. The second largest exporting territory was Florida, whose total of 165,669 tons accounted for 10.1 per cent of the 1934 shipments.

Valley Ingot Output Is Off But Mill Activity Is Well Maintained

YOUNGSTOWN, Feb. 25.—Valley steel producers have been able in the past fortnight more nearly to attune output with demand. The contra-seasonal buying movement that reached unusual proportions in December and continued to exceed the most sanguine predictions in January had caught most steel makers off guard. Stocks of ingots, billets, sheet bars, slabs and other semi-finished grades were too lean to feed rapidly expanding finishing mill schedules, and raw steel output was necessarily increased to a rate perhaps exceeding that of consumer demand. The recent drop in ingot production in the Valleys, therefore, is considered more a reflection of the balancing of demand with output than it is an indication of a receding consumption of finished steel.

Certainly, as reflected in finishing mill schedules this week, steel demand has not fallen off noticeably. Valley sheet and strip mills continue to operate at virtual capacity, and no relaxaion is yet in prospect. Some mills are sold up in many finishes of sheets and strip, principally for automotive consumption, until the end of the quarter. At present, there is no evidence here of a slackening in demand from the motor car industry.

The canning industry and the farm implement makers also are not losing importance in current Valley steel activities. Tin plate operations are above 75 per cent and should be sustained for several months if seasonal trends at packing centers continue to rule. Bars, sheets and strip steel for farm implement manufacture are

moving steadily in substantial volume.

Despite the claims for demand in miscellaneous steel-consuming industries, there is no gainsaying that automotive demand is the backbone of the Valley steel market. Other large consuming fields, such as the railroads, building construction and outlets for pipe, are not at present boons to steel order books. Lapweld and buttweld pipe production is at a low point, while seamless mill output is not tending higher. Oil country demand is the mainstay in current pipe demand. The trend toward lighter steel in transportation is gradually passing the experimental stage and may bring important tonnage to a Valley mill before many months. In the construction of tank trucks and similar automotive units, light, high-tensile steel is gaining increased application.

The scrap market has lost its January robustness. Important Valley mills have remained out of the market since Jan. 31, when about 54,000 tons was purchased by two leading steel makers. Prices of $13.75 and $13.25, delivered, were paid for No. 1 heavy melting steel. The price for that grade has softened further, and offerings are being made freely at $13, delivered.

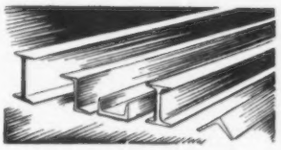
Demand for pig iron in the Valleys has been featureless during February. Ingot mold operations have accounted for a heavier movement of iron, but the merchant market is generally dull. Fourth quarter inventories still are being worked off, and important expansion in demand is not considered likely until next quarter.

All Valley producers of iron and steel are believed to have filed prices for second quarter with no essential changes from current schedules.

Detroit Scrap Prices Decline Further

DETROIT, Feb. 26.—Prices of steel scrap have given ground again with heavy melting steel and hydraulic bundles down 75c. a ton. Other items have declined 25c. to 50c. With the local steel plant out of the market for perhaps the next 30 days and with docks and yards in Detroit loaded with old material, it is believed that the large quantity of scrap scheduled to come out of the automobile industry in the next week will have to be moved to other steel-producing districts. This development is expected to weaken prices still further.

Cleveland-Lorain Rate Falls Four Points to 63 Per Cent



Demand Still Shows Slight Downward Tendency—Labor Troubles Interrupt Sheet Deliveries—Scrap Is Weak

CLEVELAND, Feb. 26.—Ingot output in the Cleveland-Lorain territory, which suffered no setback during the previous few weeks, declined four points this week to 63 per cent of capacity, two local open-hearth furnaces being shut down.

Business in finished steel shows a slight downward tendency, although with the heavy volume of orders earlier in the month the tonnage entered on the mill books this month will show only a slight decrease as compared with January. The slackening in demand has caused a moderate slowing down in bar mill operations. Most sheet mills continue to operate at capacity and, with order books well filled, no curtailment in sheet production is looked for during March. Orders from the automotive industry for a large tonnage of sheets for April shipment have been sent to the mills and these will be entered on their books March 1. Few requests have come from consumers of other products for contracts to be entered March 1.

Labor troubles among steel consuming plants in the Cleveland territory still cause anxiety and in one case necessitated the holding up of shipments of a considerable tonnage of sheets for automobile running boards.

New buying, except in sheets and to a more limited extent in bars, is not expected to be stimulated a great deal by the opening of books for the second quarter. Consumers probably will continue to order material as needed. Railroads in this territory are not furnishing much steel business, their orders being limited to small lots for repair work. A further weakening has developed in the scrap market.

Pig Iron

New business from automotive foundries in both foundry and malleable iron is holding up well. A leading producer during the week sold 5000 tons, mostly to consumers in that field and including a 1300-ton and a 1100-ton lot. This iron will be taken in before April 1. Most of the new business is from foundries that are supplementing previous purchases to cover their first quarter requirements. February shipments show an increase of 25 per cent over January.

Foundry coke shipments gained 15 per cent this month over February. That the demand for coke is not keeping pace with the increased pig iron shipments is because part of the pig iron is in malleable and steel grades. A spurt in contracting is not looked for when books are opened March 1 for the second quarter.

Sheets

Producers will enter a large tonnage of sheets for April shipment when books are opened. Consumers in the automotive field are anxious to get their orders entered as soon as books are opened for the second quarter, and have sent in orders that are to be accepted March 1. Most mills have orders for all the cold-rolled and full-finished sheets they can ship by March 31. While automobile plants are taking shipments as fast as the material can be produced, the urgency for delivery is not so acute as a few weeks ago. Shipment of a considerable tonnage of sheets for automobile running boards has been held up by a Cleveland stamping plant which delivers the fabricated boards for Ford, General Motors and Chrysler cars to the Ohio Rubber Co., Willoughby, Ohio. The operations of the Willoughby plant, which vulcanizes the rubber covering to the boards, have been curtailed by a strike.

Bars, Plates, and Shapes

Steel bars show a moderate decline in demand, although a good volume of business continues to come from forge shops doing automotive work. Alloy bar mills have about all the tonnage they can ship through March. Considerable business is expected to be placed for April shipments when books are

opened March 1 for the second quarter.

New inquiry for structural shapes is confined to small lots. A Cleveland contractor is low bidder for a blower building for the Easterly sewage disposal plant, Cleveland, requiring 305 tons of shapes and 330 tons of reinforcing bars. The only sizable lot of steel in a new list of Ohio highway projects is a bridge requiring 336 tons of bars for which bids will be taken March 8. Bids for constructing the Mohawk dam in the Muskingum conservancy district will be taken March 19 by the United States Engineers, Zanesville, Ohio. This will require 700 tons of bars and 100 tons of sheet steel piling, which will be purchased by the general contractor. There is a fair miscellaneous demand for small lots of plates.

Strip Steel

Shipments continue heavy, but new demand has subsided somewhat. Consumers in the automotive field apparently are well covered for their requirements through March and, while producers have good backlogs of orders, most mills still can take business for March shipment.

Scrap

The market is inactive and has a weak tone. While heavy melting steel is unchanged, prices on blast furnace scrap have declined 25c. to 50c. a ton, and similar reductions have been made on machine shop and short shoveling turnings and flashings, which were not marked down with heavy melting steel a week ago. Local plants are not restricting shipments of scrap, but the movement to the Youngstown district is being sharply curtailed by embargoes.

Dominion May Finance Railroad Purchases

TORONTO, ONT., Feb. 26.—Canadian railroad companies have made a proposal to the Government under which $26,000,000 may be spent on new rolling stock, rails and general equipment renewals. It is stated that of the total the Canadian Pacific plans to expend $20,000,000, while the Canadian National will spend the remainder. No information is available at this time as to what action the Government may take to assist in financing the proposed outlay.

Much of the current demand for steel is from the automotive industry although larger purchases of steel, as well as equipment, are being made by the mining industry. The building trades continue quiet and sales of structural steel are limited.

Demand for merchant pig iron is holding around 600 tons per week. While most sales are in small tonnage lots, repeat orders are appearing at more frequent intervals. The daily melt is now holding around 40 per cent of capacity. Pig iron production shows little change, with three stacks blowing and daily output averaging about 1200 tons. Imports are negligible. Prices are firm and unchanged.

Scrap sales are spotty, but in better volume than a few weeks ago. Demand runs largely to steel grades because of increased buying by the mills in the Hamilton district. Foundries are taking machinery cast and wrought scrap at regular intervals in small-tonnage lots and recently there has been a stronger demand for malleable. Offerings from the rural districts have been suspended due to winter conditions. Dealers have made no revision in price lists for the week.

Sheet Demand Holds At Cincinnati

CINCINNATI, Feb. 26.—Early second quarter interest in finished sheets indicates a continuation of heavy demand, at least well into the quarter. Of course, books for next quarter are not yet open, and won't be until March 1, but consumers are pressing mill interests to accept orders. Current demand is good, although a slight dip in total bookings was noted during the week. Rolling schedules, however, are being held at better than 90 per cent, with bookings slightly under this rate. Demand is broadening. Automotive consumption tends to a slightly lower level, while other outlets are absorbing the slack. A steady improvement in jobbing demand adds a new note of encouragement to the market situation.

Advance pig iron purchases are absent, melters being interested only in spot orders to cover urgent needs. Total February business, however, was slightly above that of January.

Better foundry operations in February moved industrial fuel consumption to a higher level.

Lack of mill interest is depressing the local scrap market. Prices are unchanged but weak. Dealers avoid speculative purchases and turn efforts toward reducing yard supplies.

Buffalo Operations Decline

BUFFALO, Feb. 26.—Bethlehem's Lackawanna plant has lowered its open-hearth operations from ten to eight furnaces. Republic Steel Corpn. continues to operate five and Wickwire-Spencer Corpn., two. Seneca sheet division of Bethlehem is at 75 per cent of capacity.

A Buffalo concern will fabricate 250 tons of steel for a highway bridge at Struthers, Ohio.

The scrap market is off, with the largest consumer offering $11 for No. 1 heavy melting steel and $9.50 for No. 2 heavy melting steel. This mill is obtaining considerable material at these prices. In addition, the second largest consumer in the district is requesting that shipments on recent orders be held up, leading to the belief that the present rate of ingot output may be decreased soon.

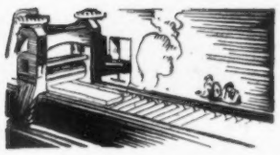
Reports from the foundries served by Buffalo pig iron furnaces are good. The Supreme Court's gold decision was received with considerable satisfaction and there has been no diminution of orders. New prices of pig iron for the second quarter are scheduled to go into effect March 1. Producers do not believe that there will be a change. Blast furnace operations are unchanged.

Boston Scrap Exports To Be Resumed

BOSTON, Feb. 26.—Aside from a slight downward revision in steel turnings, bundled skeleton and breakable cast, the market for scrap appears steadier. Pittsburgh having withdrawn from the bundled skeleton market, it is rather difficult to establish prices, but they are apparently about 25c. a ton lower. For steel turnings, $2.75 a ton, f.o.b., is the top price. Indications are that local scrap exports will resume early in March. One steamer has been chartered to load here wtihin a fortnight. Exporters continue to pay full prices for anything available. Generally speaking, however, the scrap market has been quite inactive, presumably because of the weakness that developed in prices. Local scrap exports for February to date have been 4622 tons to Italy and 2983 tons to the British Isles, a total of 7605.

Pig iron sales are infrequent and in small lots, with the aggregate for the week below 500 tons.

Eastern Pennsylvania Rate Tapers Off to 35 Per Cent



Alan Wood Furnace Likely to Go into Blast—26 Electric Railway Cars Up for Bidding—Scrap Prices Unchanged

PHILADELPHIA, Feb. 26.—Any better feeling that might have resulted from the gold clause decision has not yet been translated into improved business for the steel mills in this territory. In the absence of railroad and shipbuilding buying, this area is dependent on miscellaneous business; and at the present time this type of demand is spotty and shows a tendency to slacken in volume. Consequently one mill has taken off a furnace, and the district rate has been reduced one point to 35 per cent of capacity.

All steel sellers are looking forward to an early disposal of 600 tons of plates and shapes for a ferryboat being built by the Sun Shipbuilding Co. The first railroad equipment inquiry to appear for some time consists of 26 passenger cars and four extra trucks for electric railway service, on which bids will be taken March 15 by the Delaware River Joint Commission.

Scrap continues to be exported in undiminished volume. During 1934 Philadelphia was the fourth port in volume for such exports, with 148,667 tons, or 8.1 per cent of the total shipments from this country. Baltimore occupied seventh place with 93,471 tons, or 5.1 per cent of the total. Most of this steel went to Japan, which took 1,168,796 tons from all ports during 1934.

Pig Iron

All grades of iron have been moving in better volume during the past few weeks. Aggregate bookings in this territory amounted to about 7000 tons in January, as compared with sales of only 5000 to 6000 tons in December and even poorer tonnage in January, 1934. Unless new business shows signs of falling off, it is expected that the Swedeland furnace of the Alan Wood Steel Co. will be blown in some time in March. Pig iron will probably not show any significant activity until early March, at which time all sellers will be encouraging second quarter contracting to the fullest extent. However, the forces which tend to discourage such forward purchasing are still operative, namely, full protection against price advances and the general uncertainty as to the future of business. The trade in this area is awaiting with interest any announcement of dividends on the Troy furnace stock. It is believed that some action will be taken before the first of April.

Sheets and Strip

There is practically no demand for strip, and blue-annealed sheets are only moderately active as the result of a spotty flow of miscellaneous buying. Although the two local auto body stamping plants are working at a peak level, much of their requirements is shipped in from mills in the West. As a result, the mills in this area benefit only to a small degree from the present high rate of automobile production. It is the hope of the trade here that sufficient tank work and railroad purchasing will appear in the second quarter to enable the smaller mills to maintain their present 25 to 30 per cent operations on these two grades.

Bars, Plates, and Shapes

Outdoor building is at a standstill. There are no inquiries emanating from either Harrisburg or Trenton, and there are no large Governmental projects in this area to take up the slack as there are in most other territories. The only award of the week involved 120 tons of structural steel for a factory building at Camden, N. J., which was secured by Morris Wheeler & Co. Inc., through Thomas Gibson, general contractor. It is expected that J. S. McIlvaine will soon place an order for 250 tons required for a bridge at Lewistown, Pa. The Sun Shipbuilding Co. has been awarded a contract for building an Erie Railroad ferryboat. This job calls for 600 tons of bars, sheets, plates, shapes, and forgings, and practically every seller in the district is attempting to secure a portion of this tonnage.

Scrap

For the fifth week Lukens is holding up shipments, and neither Alan Wood nor Worth is purchasing heavy steels. Consequently this market continues to have an uncertain undertone, and it is only the unchanged brokers' buying prices for export steels which are preventing actual mark-downs on the quotations of all grades. At present there are accumulations aggregating close to 15,000 tons at Port Richmond awaiting shipment abroad. A partly loaded vessel is expected to dock during the week, and two large Japanese boats are due next week. Export loadings at Baltimore have fallen off because of the price competition of Bethlehem buying for Sparrows Point. Total foreign shipments from North Atlantic ports are now just as large as they ever have been. In addition, it is expected that a considerable quantity of new business will be placed shortly, thereby assuring a continuance of heavy shipments until the middle of the year.

Railroad Orders Lift Output in South

BIRMINGHAM, Feb. 26.—All current steel and pig iron prices have been reaffirmed for the second quarter and books will be opened for the next period on March 1.

Bookings of steel tonnage have shot sharply upward as a result of railroad buying. Rail orders of the Tennessee Coal, Iron & Railroad Co. now exceed 60,000 tons and there is also additional tonnage in track accessories. Other heavy products, however, are sluggish. Wire products and sheets are moving at a fair rate.

Thirteen open-hearth units operated last week and this schedule will be continued during the present week. The Tennessee company is working five at Ensley and five at Fairfield, while Gulf States Steel has three on at Alabama City.

The pig iron market is not very active. Buying is now largely on a spot basis. February shipments did not come up to earlier expectations but were about equal to those of January. A pickup had been looked for.

Eight blast furnaces are active, and around March 1 this number will be increased to nine when Republic Steel blows in a second stack.

Prices of Finished Steel and Iron Products

BARS, PLATES, SHAPES

Iron and Steel Bars

Soft Steel	*Base per Lb.*
F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
F.o.b. Gary	1.85c.
F.o.b. Duluth	1.95c.
Del'd Detroit	1.95c.
F.o.b. Cleveland	1.85c.
F.o.b. Buffalo	1.90c.
Del'd Philadelphia	2.09c.
Del'd New York	2.13c.
F.o.b. Birmingham	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.

Rail Steel
(For merchant trade)

F.o.b. Pittsburgh	1.70c.
F.o.b. Chicago	1.75c.
F.o.b. Gary	1.75c.
F.o.b. Moline, Ill.	1.75c.
F.o.b. Cleveland	1.75c.
F.o.b. Buffalo	1.80c.
F.o.b. Birmingham	1.85c.
F.o.b. cars dock Gulf ports	2.10c.
F.o.b. cars dock Pacific ports	2.25c.

Billet Steel Reinforcing
(Straight lengths as quoted by distributers)

F.o.b. Pittsburgh	2.05c.
F.o.b. Chicago	2.10c.
F.o.b. Gary	2.10c.
Del'd Detroit	2.20c.
F.o.b. Cleveland	2.10c.
F.o.b. Youngstown	2.10c.
F.o.b. Buffalo	2.10c.
F.o.b. Birmingham	2.10c.
F.o.b. cars dock Gulf ports	2.45c.
F.o.b. cars dock Pacific ports	2.45c.

Rail Steel Reinforcing
(Straight lengths as quoted by distributers)

F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.95c.
F.o.b. Gary	1.95c.
F.o.b. Cleveland	1.95c.
F.o.b. Youngstown	1.95c.
F.o.b. Buffalo	1.95c.
F.o.b. Birmingham	1.95c.
F.o.b. cars dock Gulf ports	2.30c.
F.o.b. cars dock Pacific ports	2.30c.

Iron

F.o.b. Chicago	1.80c.
F.o.b. Terre Haute, Ind.	1.75c.
F.o.b. Louisville, Ky.	2.10c.
F.o.b. Danville, Pa.	1.80c.
F.o.b. Berwick, Pa.	1.70c.

Cold Finished Bars and Shafting*

	Base per Lb.
F.o.b. Pittsburgh	2.10c.
F.o.b. Chicago	2.10c.
F.o.b. Gary	2.15c.
F.o.b. Cleveland	2.15c.
F.o.b. Buffalo	2.20c.
Del'd Detroit	2.30c.
Del'd eastern Michigan	2.35c.

* In quantities of 10,000 to 19,000 lb.

Fence and Sign Posts

Angle Line Posts	*Base per Net Ton*
F.o.b. Pittsburgh	$50.00
F.o.b. Chicago	50.00
F.o.b. Duluth	51.00
F.o.b. Cleveland	50.00
F.o.b. Birmingham	53.00
F.o.b. Houston, Orange, Beaumont, Galveston	59.00
F.o.b. Mobile	58.00
F.o.b. New Orleans, Lake Charles, Corpus Christi	59.00
F.o.b. cars dock Pacific ports	63.00

Plates

	Base per Lb.
F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
F.o.b. Gary	1.85c.
Del'd Cleveland	1.985c.
F.o.b. Coatesville	1.90c.
F.o.b. Sparrows Point	1.90c.
Del'd Philadelphia	1.985c.
Del'd New York	2.08c.
F.o.b. Birmingham	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.
Wrought iron plates, f.o.b. P'gh	3.00c.

Floor Plates

F.o.b. Pittsburgh	3.35c.
F.o.b. Chicago	3.40c.
F.o.b. Coatesville	3.45c.
F.o.b. cars dock Gulf ports	3.75c.
F.o.b. cars dock Pacific ports	3.90c.

Structural Shapes

	Base per Lb.
F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
Del'd Cleveland	1.985c.
F.o.b. Buffalo	1.90c.
F.o.b. Bethlehem	1.90c.
Del'd Philadelphia	2.005c.
Del'd New York	2.0525c.
F.o.b. Birmingham (standard)	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.

Steel Sheet Piling

	Base per Lb.
F.o.b. Pittsburgh	2.15c.
F.o.b. Chicago	2.25c.
F.o.b. Buffalo	2.25c.
F.o.b. cars dock Gulf ports	2.60c.
F.o.b. cars dock Pacific ports	2.60c.

SHEETS, STRIP, TIN PLATE TERNE PLATE

Sheets

Hot Rolled

	Base per Lb.
No. 10, f.o.b. Pittsburgh	1.85c.
No. 10, f.o.b. Gary	1.95c.
No. 10, del'd Detroit	2.05c.
No. 10, del'd Phila.	2.14c.
No. 10, f.o.b. Birmingham	2.00c.
No. 10, f.o.b. dock cars Pacific ports	2.40c.

Hot-Rolled Annealed

No. 24, f.o.b. Pittsburgh	2.40c.
No. 24, f.o.b. Gary	2.50c.
No. 24, del'd Detroit	2.60c.
No. 24, del'd Phila.	2.69c.
No. 24, f.o.b. Birmingham	2.55c.
No. 24, f.o.b. dock cars Pacific ports	3.05c.
No. 24, wrought iron, Pittsburgh	4.30c.

Heavy Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh	2.50c.
No. 10 gage, f.o.b. Gary	2.60c.
No. 10 gage, del'd Detroit	2.70c.
No. 10 gage, del'd Phila.	2.79c.
No. 10 gage, f.o.b. Birmingham	2.65c.
No. 10 gage, f.o.b. dock cars Pacific ports	3.10c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh	2.95c.
No. 20 gage, f.o.b. Gary	3.05c.
No. 20 gage, del'd Detroit	3.15c.
No. 20 gage, del'd Phila.	3.24c.
No. 20 gage, f.o.b. Birmingham	3.10c.
No. 20 gage, f.o.b. dock cars Pacific ports	3.50c.

Galvanized Sheets

No. 24, f.o.b. Pittsburgh	3.10c.
No. 24, f.o.b. Gary	3.20c.
No. 24, del'd Phila.	3.39c.
No. 24, f.o.b. Birmingham	3.25c.
No. 24 f.o.b. dock cars Pacific ports	3.70c.
No. 24, wrought iron, Pittsburgh	4.95c.

Long Ternes

No. 24, unassorted 8-lb. coating f.o.b. Pittsburgh	3.40c.
F.o.b. cars dock Pacific ports	4.10c.

Vitreous Enameling Stock

No. 20, f.o.b. Pittsburgh	3.10c.

Tin Mill Black Plate

No. 28, f.o.b. Pittsburgh	2.75c.
No. 28, Gary	2.85c.
No. 28, cars dock, Pacific Coast ports	3.35c.

Tin Plate

	Per Base Box
Standard cokes, f.o.b. P'gh district mill	$5.25
Standard cokes, f.o.b. Gary	5.35
Standard cokes, f.o.b. cars dock Pacific ports	5.90

Terne Plate

(F.o.b. Pittsburgh)
(Per Package, 20 x 28 in.)

8-lb. coating I.C.	$10.00
15-lb. coating I.C.	12.00
20-lb. coating I.C.	13.00
25-lb. coating I.C.	14.00
30-lb. coating I.C.	15.25
40-lb. coating I.C.	17.50

Hot-Rolled Hoops, Bands, Strips and Flats under ¼ in.

	Base per Lb.
All widths up to 24 in., P'gh	1.85c.
All widths up to 24 in., Chicago	1.95c.
All widths up to 24 in., del'd Detroit	2.05c.
All widths up to 24 in., Birmingham	2.00c.
Cooperage stock, Pittsburgh	2.10c.
Cooperage stock, Chicago	2.20c.

Cold-Rolled Strips

	Base per Lb.
F.o.b. Pittsburgh	2.60c.
F.o.b. Cleveland	2.60c.
Del'd Chicago	2.88c.
F.o.b. Worcester	2.80c.

Fender Stock

No. 14, Pittsburgh or Cleveland	2.90c.
No. 14, Worcester	3.30c.
No. 20, Pittsburgh or Cleveland	3.30c.
No. 20, Worcester	3.70c.

Hot-Rolled Rail Steel Strips

	Base per Lb.
F.o.b. Pittsburgh	1.70c.
F.o.b. Chicago	1.75c.
F.o.b. Birmingham	1.85c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh and Cleveland.)

To Manufacturing Trade	*Per Lb.*
Bright wire	2.30c.
Spring wire	2.90c.

Chicago prices on products sold to the manufacturing trade are $1 a ton above Pittsburgh or Cleveland. Worcester and Duluth prices are $2 a ton above, Birmingham $3 above, and Pacific Coast prices $9 a ton above Pittsburgh or Cleveland.

To Jobbing Trade

Qualified jobbers are entitled to a reduction of 20c. a 100 lb. from the base price on carload shipments to stock, and of 10c. a 100 lb. on less-carload shipments to stock.

	Base per Keg
Standard wire nails	$2.60
Smooth coated nails	2.60
Galvanized nails:	
15 gage and coarser	4.60
16 gage and finer	5.10

	Base per 100 Lb.
Annealed fence wire	$2.45
Galvanized fence wire	2.80
Polished staples	3.30
Galvanized staples	3.55
Barbed wire, galvanized	3.00
Woven wire fence, base column	63.00

Chicago and Anderson, Ind., mill prices are $1 a ton over Pittsburgh base (on all products except woven wire fence, for which the Chicago price is $2 above Pittsburgh), Duluth, Minn., and Worcester, Mass., mill prices are $2 a ton over Pittsburgh (except for woven wire fence at Duluth which is $3 over Pittsburgh), and Birmingham mill prices are $3 a ton over Pittsburgh.

On wire nails, barbed wire, staples and fence wire, prices at Houston, Galveston and Corpus Christi, Tex., New Orleans, Lake Charles, La., and Mobile, Ala., are $6 a ton over Pittsburgh, while Pacific Coast prices are $8 over Pittsburgh. Exception: on fence wire Pacific Coast prices are $11 a ton above Pittsburgh.

On staples and barbed wire, prices of $6 a ton above Pittsburgh are also quoted at Beaumont and Orange, Tex.

Wire Hoops, Twisted or Welded

	Off List
F.o.b. Pittsburgh	35 and 2½ off
F.o.b. Chicago	35 off

STEEL AND WROUGHT PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

F.o.b. Pittsburgh only on wrought iron pipe.

Butt Weld

Steel Inches	Black	Galv.	Wrought Iron Inches	Black	Galv.
⅛	51½	29½	⅛	+91½	+138
¼ to ⅜	53½	35	¼ & ⅜	+11½	+21½
½	58½	47	½	31½	15
¾	62	52	¾	36½	20½
1 to 3	64	55	1 & 1¼	39½	25½
			1½	43½	28
			2	41½	26

Lap Weld

2	60	51	2	37	22½
2½ to 3	63	54	2½ to 3½	38	25
3½ to 6	65	56	4 to 8	40	28½
7 and 8	64	54	9 to 12	38	24½
9 and 10	63½	53½			
11 and 12	62½	52½			

Butt Weld, extra strong, plain ends

⅛	48½	33½	⅛	+13	+45½
¼ to ⅜	51	38	¼ & ⅜	+2½	+34½
½	56½	47½	½	32½	17½
¾	61	52	¾	37½	22½
1 to 3	63	55	1 to 2	43½	29

Lap Weld, extra strong, plain ends

2	58	50	2	40	26
2½ to 3	62	54	2½ to 4	45½	33
3½ to 6	65½	57½	4½ to 6	45	33½
7 and 8	64½	54½	7 & 8	46	33
9 and 10	63½	53½	9 to 12	41½	30
11 and 12	62½	52½			

On standard steel pipe an extra 5% off is allowed on sales to consumers while two 5's off apply on sales to jobbers. On less-than-carload shipments prices are determined by adding 20 and 25% and the carload freight rate to the base card. On structural steel pipe the base card is reduced 2 points and two 5's off are allowed to consumers and three 5's off to jobbers.

Note—Chicago district mills have a base two points less than the above discounts Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, Ohio, and Chicago district mills, the billing being from the point producing the lowest price to destination.

Boiler Tubes

Seamless Steel Commercial Boiler Tubes and Locomotive Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots)

		Cold Drawn	Hot Rolled
1 in. o.d.	13 B.W.G.	$ 8.60	$7.25
1¼ in. o.d.	13 B.W.G.	10.19	9.35
1½ in. o.d.	13 B.W.G.	11.26	10.23
1¾ in. o.d.	13 B.W.G.	12.81	11.64
2 in. o.d.	13 B.W.G.	14.35	13.04
2¼ in. o.d.	13 B.W.G.	16.00	14.54
2½ in. o.d.	12 B.W.G.	19.29	17.54
2¾ in. o.d.	12 B.W.G.	20.45	18.59
3 in. o.d.	12 B.W.G.	21.45	19.50
4½ in. o.d.	10 B.W.G.	41.08	37.35
3½ in. o.d.	11 B.W.G.	27.09	24.63
4 in. o.d.	10 B.W.G.	33.60	30.54
4½ in. o.d.	10 B.W.G.	41.08	37.35
5 in. o.d.	9 B.W.G.	51.56	46.87
6 in. o.d.	7 B.W.G.	79.15	71.94

Extras for less-carload quantities:
25,000 lb. or ft. to 39,999 lb. or ft. 5 %
10,000 lb. or ft. to 24,999 lb. or ft. 12½%
2,000 lb. or ft. to 9,999 lb. or ft. 25 %
Under 2,000 lb. or ft. 40 %

Hot-Finished Lapweld Steel Pressure Tubes

(Net base prices per 100 ft., f.o.b. Pittsburgh, in carload lots)

1½ in o.d.	13 B.W.G.	$ 9.73
1¾ in. o.d.	13 B.W.G.	11.06
2 in. o.d.	13 B.W.G.	12.23
2¼ in. o.d.	13 B.W.G.	13.73
2½ in. o.d.	12 B.W.G.	16.58
2¾ in. o.d.	12 B.W.G.	17.54
3 in. o.d.	12 B.W.G.	18.35
3¼ in. o.d.	11 B.W.G.	21.56
3½ in. o.d.	11 B.W.G.	22.15
4 in. o.d.	10 B.W.G.	28.60
4½ in. o.d.	10 B.W.G.	35.22
5 in. o.d.	9 B.W.G.	44.25
6 in. o.d.	7 B.W.G.	68.16

Quantity Extras:
40,000 lb. or ft. base
25,000 lb. or ft. to 39,999 lb. or ft. plus 5%
10,000 lb. or ft. to 24,999 lb. or ft. plus 12½%
2,000 lb. or ft. to 9,999 lb. or ft. plus 25 %
Under 2,000 lb. or ft. plus 40 %

CHARCOAL IRON BOILER TUBES

Base Discounts, f.o.b. Pittsburgh

In. O. D.	
1½ and 1¾	44
2 —2¼	16 and 10
2½—2¾	16 and 10
3	17 and 10
3¼—3½	18 and 10
4	20 and 10
4½, 5, 6	21 and 10

Extras for quantity: For 1½ to 1¾, up 8 points under 10,000 lb., up 4 points 10,000 lb. to carload. For 2 in. to 3¼ in., up 2 points without supplementary 10 per cent, under 10,000 lb.; supplementary 5 per cent instead of supplementary 10 per cent for 10,000 lb. to carload.

In sizes 2 in. to 4½ in. O.D. inclusive, all tubes more than four gages heavier than standard are priced per lb. as follows: Carload and over, 9c.; extras for quantity—under 10,000 lb. 1c. per lb., 10,000 lb. to carload ½c. per lb.

CAST IRON WATER PIPE

	Per Net Ton
*6-in. and larger, del'd Chicago	$47.00
*4-in., del'd Chicago	50.00
6-in. and larger, del'd New York	45.00
4-in. del'd New York	48.00
*6-in. and larger, Birmingham	39.00
*4-in. Birmingham	42.00

Class "A" and gas pipe, $3 extra.
*Prices for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $38, Birmingham, and $46, delivered Chicago, and 4-in pipe $41, Birmingham, and $49 a ton, delivered Chicago.

RAILROAD MATERIALS

Rails and Track Supplies

F.o.b. Mill

Standard rails, heavier than 60 lb., per gross ton	$36.37½
Angle bars, per 100 lb.	2.55

F.o.b. Code Basing Points

Light rails (from billets) per gross ton	$35.00
Light rails (from rail steel) per gross ton	34.00

	Base per 100 Lb.
Spikes, 9/16 in. and larger	$2.60
Spikes, ½ in. and smaller	2.40
Spikes, boat and barge	2.40
Tie plates, steel	1.90
Tie plates, Pacific Coast ports	2.00
Track bolts, to steam railroads	2.55
Track bolts, no jobbers, all sizes (per 100 count)	70 per cent off list

Basing points on light rails are Pittsburgh, Chicago and Birmingham; on spikes and tie plates, Pittsburgh, Chicago, Buffalo, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minneapolis, Colo., Birmingham and Pacific Coast ports; on tie plates alone, Steelton, Pa.; on spikes alone, Cleveland, Youngstown, Lebanon, Pa., Columbia, Pa., Richmond, Va., Jersey City, N. J.

BOLTS, NUTS, RIVETS AND SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

	Per Cent Off List
Machine bolts	70, 10 and 10
Carriage bolts	70, 10 and 10
Lag bolts	70, 10 and 10
Plow bolts, Nos. 1, 2, 3 and 7 heads	70, 10 and 10
Hot-pressed nuts, blank or tapped, square	70, 10 and 10
Hot-pressed nuts, blank or tapped, hexagons	70, 10 and 10
C.p.c. and t. square or hex. nuts, blank or tapped	70, 10 and 10
Semi-finished hexagon nuts, U.S.S. all sizes	70, 10 and 10
Semi-finished hexagon nuts, S.A.E. ¼ in. to 7/16 in. diameter	70, 10 and 10
½ in. to 1 in. diameter	70, 10 and 10
larger than 1 in. diameter	70, 10 and 10
Store bolts in packages, Pittsburgh	75
Store bolts in packages, Chicago	75
Store bolts in packages, Cleveland	75
Store bolts in bulk, P'gh.	83
Store bolts in bulk, Chicago	83
Store bolts in bulk, Cleveland	83
Tire bolts	60 and 10

Large Rivets

(½-in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh or Cleveland	$2.90
F.o.b. Chicago	3.00
F.o.b. Birmingham	3.05

Small Rivets

(7/16-in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh	70 and 5
F.o.b. Cleveland	70 and 5
F.o.b. Chicago and Birm'g'm	70 and 5

Cap and Set Screws

(Freight allowed up to but not exceeding 65c. per 100 lb. on lots of 200 lb. or more)

	Per Cent Off List
Milled cap screws, 1 in. dia. and smaller	80, 10 and 10
Milled standard set screws, case hardened, 1 in. dia. and smaller	75
Milled headless set screws, cut thread ¾ in. and smaller	75
Upset hex. head cap screws, U.S.S.S. or S.A.E. thread, 1 in. dia. and smaller	85
Upset set screws, cut and oval point	75 and 10 to 80
Milled studs	65 to 65 and 10

Alloy and Stainless Steel

Alloy Steel Ingots

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem.
Uncropped ..... $40 per gross ton

Alloy Steel Blooms, Billets and Slabs

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem.
Base price, $49 a gross ton.

Alloy Steel Bars

Price del'd Detroit is $52.
F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.
Open-hearth grade, base ..... 2.45c.
Delivered price at Detroit is ..... 2.60c.

S.A.E. Series Numbers	Alloy Differential per 100 lb.
2000 (½% Nickel)	$0.25
2100 (2½% Nickel)	0.55
2300 (3½% Nickel)	1.50
2500 (5% Nickel)	2.25
3100 Nickel Chromium	0.55
3200 Nickel Chromium	1.35
3300 Nickel Chromium	3.80
3400 Nickel Chromium	3.20
4100 Chromium Molybdenum (0.15 to 0.25 Molybdenum)	0.50
4100 Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70
4600 Nickel Molybdenum (0.20 to 0.30 Molybdenum) (1.50 to 2.00 Nickel)	1.05
5100 Chromium Steel (0.60 to 0.90 Chromium)	0.35
5100 Chromium Steel (0.80 to 1.10 Chromium)	0.45
6100 Chromium Spring Steel	base
6100 Chromium Vanadium Bar.	1.20
6100 Chromium Vanadium Spring Steel	0.70
Chromium Nickel Vanadium	1.50
Carbon Vanadium	0.95

These prices are for hot-rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. The differential for cold-drawn bars is ½c. per lb. higher with separate extras. Blooms, billets and slabs under 4x4 in. or equivalent are sold on the bar base. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base. Sections 4x4 in. to 10x10 in. or equivalent carry a gross ton price, which is the net price for bars for the same analysis. Larger sizes carry extras.

Alloy Cold-Finished Bars

F.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo, 2.95c. base per lb.

STAINLESS STEEL No. 302

17 to 19% Cr, 7 to 9% Ni, 0.08 to 0.20% C.)
(Base Prices, f.o.b. Pittsburgh)

	Per Lb.
Forging billets	19.55c.
Rerolling slabs	15c.
Bars	23c.
Plates	26c.
Structural shapes	23c.
Sheets	33c.
Hot-rolled strip	20½c.
Cold-rolled strip	27c.
Drawn wire	23c.

Raw and Semi-Finished Steel

Carbon Steel Rerolling Ingots

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham.
Uncropped ..... $29 per gross ton

Carbon Steel Forging Ingots

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Birmingham.
Uncropped ..... $31 per gross ton

Billets, Blooms and Slabs

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham.

	Per Gross Ton
Rerolling	$27.00
Forging quality	32.00

Delivered Detroit

Rerolling	$30.00
Forging	35.00

Billets Only F.o.b. Duluth

Rerolling	$29.00
Forging	34.00

Sheet Bars

F.o.b. Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open-hearth or Bessemer	$28.00

Skelp

F.o.b. Pittsburgh, Chicago, Youngstown, Buffalo, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved	1.70c.
Universal	1.70c.
Sheared	1.70c.

Tube Rounds

	Base per Lb.
F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
F.o.b. Cleveland	1.85c.
F.o.b. Buffalo	1.90c.
F.o.b. Birmingham	1.95c.

Wire Rods

(Common, base)

	Per Gross Ton
F.o.b. Pittsburgh	$38.00
F.o.b. Cleveland	38.00
F.o.b. Chicago	39.00
F.o.b. Anderson, Ind.	39.00
F.o.b. Youngstown	39.00
F.o.b. Worcester, Mass.	40.00
F.o.b. Birmingham	41.00
F.o.b. San Francisco	47.00
F.o.b. Galveston	44.00

Pig Iron and Ferroalloys

PIG IRON

PRICES PER GROSS TON AT BASING POINTS

Basing Points	No. 2 Fdry.	Malleable	Basic	Bessemer
Everett, Mass.	$19.50	$20.00	$19.00	$20.50
Bethlehem, Pa.	19.50	20.00	19.00	20.50
Birdsboro, Pa.	19.50	20.00	19.00	20.50
Swedeland, Pa.	19.50	20.00	19.00	20.50
Steelton, Pa.	....	....	19.00	....
Sparrows Point, Md.	19.50	....	19.00	....
Neville Island, Pa.	18.50	18.50	18.00	19.00
Sharpsville, Pa.	18.50	18.50	18.00	19.00
Youngstown	18.50	18.50	18.00	19.00
Buffalo	18.50	19.00	17.50	19.50
Erie, Pa.	18.50	19.00	18.00	19.50
Cleveland	18.50	18.50	18.00	19.00
Toledo, Ohio	18.50	18.50	18.00	19.00
Jackson, Ohio	20.25	20.25	19.75	....
Detroit	18.50	18.50	18.00	19.00
Hamilton, Ohio	18.50	18.50	18.00	19.00
Chicago	18.50	18.50	18.00	19.00
Granite City, Ill.	18.50	18.50	18.00	....
Duluth, Minn.	19.00	19.00	....	19.50
Birmingham	14.50	14.50	13.50	19.00
Provo, Utah	17.50	....	17.00	....

DELIVERED PRICES PER GROSS TON AT CONSUMING CENTERS

	No. 2 Fdry.	Malleable	Basic	Bessemer
Boston Switching District From Everett, Mass.	$20.00	$20.50	$19.50	$21.00
Brooklyn From East. Pa. or Buffalo	21.77	22.27	21.27	22.77
Newark or Jersey City, N. J. From East. Pa. or Buffalo	20.89	21.39	20.39	21.89
Philadelphia From Eastern Pa.	20.26	20.76	19.76	21.26
Cincinnati From Hamilton, Ohio	19.51	19.51	19.01	20.01
Canton, Ohio From Cleveland and Youngstown	19.76	19.76	19.26	20.26
Columbus, Ohio From Hamilton, Ohio	20.50	20.50	....	....
Mansfield, Ohio From Cleveland and Toledo	20.26	20.26	....	....
Indianapolis From Hamilton, Ohio	20.77	20.77	....	....
South Bend, Ind. From Chicago	20.55	20.55	....	....
Milwaukee From Chicago	19.50	19.50	....	....
St. Paul From Duluth	20.94	....	....	....
Davenport, Iowa From Chicago	20.26	20.26	....	....
Kansas City From Granite City	21.04	21.04	....	....

Delivered prices on Southern iron for shipment to Northern points are 38c. a gross ton below delivered prices from the nearest Northern basing points.

LOW PHOSPHORUS PIG IRON

Basing points: Birdsboro, Pa., Steelton, Pa., and Standish, N. Y. $23.50

GRAY FORGE PIG IRON

Valley furnace	$18.00
Pittsburgh district furnace	18.00

CHARCOAL PIG IRON

Lake Superior furnace	$21.00
Delivered Chicago	24.04
Delivered Buffalo	24.28

CANADA

Pig Iron

Per gross ton:

Delivered Toronto

No. 1 fdy., sil. 2.25 to 2.75	$21.00
No. 2 fdy., sil. 1.75 to 2.75	20.50
Malleable	21.00

Delivered Montreal

No. 1 fdy., sil. 2.25 to 2.75	$22.50
No. 2 fdy., sil. 1.75 to 2.25	22.00
Malleable	22.50
Basic	22.00

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

	Per Gross Ton
Domestic, 80% (carload)	$85.00

Spiegeleisen

	Per Gross Ton Furnace
Domestic, 19 to 21%	$26.00

Electric Ferrosilicon

	Per Gross Ton Delivered
50% (carloads)	$77.50
50% (ton lots)	85.00
75% (carloads)	126.00
75% (ton lots)	136.00

Silvery Iron

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
6%	$22.75	12%	$29.25
7%	23.75	13%	30.75
8%	24.75	14%	32.25
9%	25.75	15%	33.75
10%	26.75	16%	35.25
11%	27.75	17%	36.75

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Bessemer Ferrosilicon

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
10%	$27.75	14%	$33.25
11%	28.75	15%	34.75
12%	30.25	16%	36.25
13%	31.75	17%	37.75

Manganese 1½ to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional. Phosphorus 0.75% or over, $1 ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Other Ferroalloys

Ferrotungsten, per lb. contained W. del., carloads	$1.35 to $1.45
Ferrotungsten, less carloads	1.45 to 1.55
Ferrochromium, 4 to 6% carbon and up, 65 to 70% Cr. per lb. contained Cr. delivered, in carloads	10.00c.
Ferrochromium, 2% carbon	16.50c. to 17.00c.
Ferrochromium, 1% carbon	17.50c. to 18.00c.
Ferrochromium, 0.10% carbon	19.50c. to 20.00c.
Ferrochromium, 0.06% carbon	20.00c. to 20.50c.
Ferrovanadium, del., per lb. contained V	$2.70 to $2.90
Ferrocarbontitanium, 15 to 18% Ti, 6 to 8% C, f.o.b. furnace carload and contract per net ton	$137.50
Ferrophosphorus, electric, or blast furnace material, in carloads, 18%, Rockdale, Tenn., base, per gross ton with $2 unitage	50.00
Ferrophosphorus, electric, 24% f.o.b. Anniston, Ala., per gross ton with $2.75 unitage	65.00
Ferromolybdenum, per lb. Mo., del.	95c.
Calcium molybdate, per lb. Mo., del.	80c.
Silico spiegel, per ton, f.o.b. furnace, car lots	$38.00
Ton lots or less per ton	45.50
Silico-manganese, gross ton, delivered: 2.50% carbon grade	90.00
2% carbon grade	95.00
1% carbon grade	106.00
Spot prices	$5 a ton higher

Iron and Steel Scrap

PITTSBURGH

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$12.50 to $13.00
No. 2 heavy melting steel	11.50 to 12.00
No. 2 railroad wrought	12.50 to 13.00
Scrap rails	13.50 to 14.00
Rails 3 ft. and under	14.50 to 15.00
Compressed sheet steel	12.25 to 12.75
Hand bundled sheet steel	11.50 to 12.00
Hvy. steel axle turnings	10.50 to 11.00
Machine shop turnings	8.00 to 8.50
Short shov. turnings	8.00 to 8.50
Short mixed borings and turnings	6.75 to 7.25
Cast iron borings	6.75 to 7.25
Cast iron carwheels	12.75 to 13.25
Heavy breakable cast	12.00 to 12.50
No. 1 cast	13.00 to 13.50
Railr. knuckles and couplers	14.50 to 15.00
Rail. coil and leaf springs	14.50 to 15.00
Rolled steel wheels	14.50 to 15.00
Low phos. billet crops	15.00 to 15.50
Low phos. sheet bar crops	15.00 to 15.50
Low phos. plate scrap	14.00 to 14.50
Low phos. punchings	14.00 to 14.50
Steel car axles	15.00 to 15.50

CHICAGO

Delivered Chicago district consumers:

	Per Gross Ton
Heavy melting steel	$10.50 to $11.00
Automobile hvy. melt. steel	10.25 to 10.75
Shoveling steel	10.50 to 11.00
Hydraulic comp. sheets	9.50 to 10.00
Drop forge flashings	9.25 to 9.75
No. 1 busheling	9.00 to 9.50
Rolled carwheels	12.00 to 12.50
Railroad tires	12.50 to 13.00
Railroad leaf springs	12.00 to 12.50
Axle turnings	10.00 to 10.50
Steel couplers and knuckles	12.00 to 12.50
Coil springs	12.50 to 13.00
Axle turnings (elec. fur.)	11.00 to 11.50
Low phos. punchings	12.50 to 13.00
Low phos. plates, 12 in. an under	13.75 to 14.25
Cast iron borings	7.00 to 7.50
Short shoveling turnings	7.00 to 7.50
Machine shop turnings	6.00 to 6.50
Rerolling rails	12.50 to 13.00
Steel rails, less than 3 ft.	13.25 to 13.75
Steel rails, less than 2 ft.	14.00 to 14.50
Angle bars, steel	12.50 to 13.00
Cast iron carwheels	12.00 to 12.50
Railroad malleable	13.00 to 13.50
Agricultural malleable	9.50 to 10.00

	Per Net Ton
Iron car axles	$15.50 to $16.00
Steel car axles	14.75 to 15.25
No. 1 railroad wrought	8.75 to 9.25
No. 2 railroad wrought	8.50 to 9.00
No. 2 busheling	5.50 to 6.00
Locomotive tires, smooth	10.00 to 10.50
Pipe and flues	5.50 to 6.00
No. 1 machinery cast	10.00 to 10.50
Clean automobile cast	9.50 to 10.00
No. 1 railroad cast	9.00 to 9.50
No. 1 agricultural cast	9.00 to 9.50
Stove plate	6.50 to 7.00
Grate bars	6.50 to 7.00
Brake shoes	7.00 to 7.50

PHILADELPHIA

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$11.50
No. 2 heavy melting steel	10.00
No. 1 railroad wrought	10.75 to 11.25
Bundled sheets	9.50 to 10.00
Hydraulic compressed, new	11.00 to 11.50
Hydraulic compressed, old	7.50 to 8.00
Machine shop turnings	6.50 to 7.00
Heavy axle turnings	8.50 to 9.00
Cast borings	5.00 to 5.50
Stove plate (steel works)	8.50 to 9.00
Heavy breakable cast	10.50 to 11.00
No. 1 low phos. heavy	15.00 to 15.50
Couplers and knuckles	14.50 to 15.00
Rolled steel wheels	14.50 to 15.00
No. 1 blast furnace	5.00 to 5.50
Spec. iron and steel pipe	8.00 to 8.50
Shafting	17.00 to 17.50
Steel axles	16.50 to 17.00
No. 1 forge fire	9.50 to 10.00
Cast iron carwheels	12.25 to 12.75
No. 1 cast	11.00 to 11.50
Cast borings (chem.)	12.00 to 14.00
Steel rails for rolling	12.00 to 12.50

CINCINNATI

Dealers' buying prices per gross ton:

Heavy melting steel	$8.50 to $9.00
Scrap rails for melting	8.50 to 9.00
Loose sheet clippings	5.00 to 5.50
Bundled sheets	6.50 to 7.00
Cast iron borings	5.00 to 5.50
Machine shop turnings	5.00 to 5.50
No. 1 busheling	6.50 to 7.00
No. 2 busheling	3.25 to 3.75
Rails for rolling	9.50 to 10.00
No. 1 locomotive tires	7.75 to 8.25
Short rails	12.00 to 12.50
Cast iron carwheels	8.50 to 9.00
No. 1 machinery cast	9.75 to 10.25
No. 1 railroad cast	9.00 to 9.50
Burnt cast	6.50 to 7.00
Stove plate	6.50 to 7.00
Agricultural malleable	8.50 to 9.00
Railroad malleable	9.50 to 10.00

CLEVELAND

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$10.75 to $11.25
No. 2 heavy melting steel	10.25 to 10.75
Compressed sheet steel	10.00 to 10.50
Light bundled sheet stampings	8.00 to 8.50
Drop forge flashings	9.50 to 10.00
Machine shop turnings	7.25 to 7.75
Short shoveling turnings	7.75 to 8.25
No. 1 busheling	9.50 to 10.00
Steel axle turnings	9.50 to 10.00
Low phos. billet crops	14.50 to 15.00
Cast iron borings	7.50 to 8.00
Mixed borings and short turnings	7.50 to 8.00
No. 2 busheling	7.50 to 8.00
No. 1 cast	12.50 to 13.00
Railroad grate bars	7.00 to 7.50
Stove plate	8.00 to 8.50
Rails under 3 ft.	15.00 to 15.50
Rails for rolling	15.50 to 16.00
Railroad malleable	13.00 to 13.50
Cast iron carwheels	.... to 12.00

BUFFALO

Per gross ton, f.o.b. Buffalo consumers' plants:

No. 1 heavy melting steel	$10.75 to $11.25
No. 2 heavy melting scrap	9.25 to 9.75
Scrap rails	12.00 to 12.50
New hydraul. comp. sheets	9.25 to 9.75
Old hydraul. comp. sheets	10.00 to 10.50
Drop forge flashings	9.25 to 9.75
No. 1 busheling	9.25 to 9.75
Hvy. steel axle turnings	8.00 to 8.50
Machine shop turnings	.... to 6.25
Knuckles and couplers	12.00 to 12.50
Coil and leaf springs	12.00 to 12.50
Rolled steel wheels	12.00 to 12.50
Low phos. billet crops	13.75 to 14.25
Short shov. steel turnings	7.25 to 7.50
Short mixed borings and turnings	7.25 to 7.50
Cast iron borings	7.25 to 7.50
No. 2 busheling	7.50 to 8.00
Steel car axles	13.50 to 14.00
Iron axles	13.50 to 14.00
No. 1 machinery cast	12.00 to 12.50
No. 1 cupola cast	10.50 to 11.00
Stove plate	10.00 to 10.50
Steel rails, 3 ft. and under	14.00 to 14.50
Cast iron carwheels	11.50 to 12.00
Industrial malleable	12.50 to 13.00
Railroad malleable	12.50 to 13.00
Chemical borings	8.50 to 9.00

BOSTON

Dealers' buying prices per gross ton:

*No. 1 heavy melting steel	$9.00 to $9.25
No. 1 heavy melting steel	7.00 to 7.25
Scrap T rails	7.75 to 8.00
*No. 2 steel	8.25 to 8.50
No. 2 steel	6.00 to 6.50
Breakable cast	5.75 to 6.00
Machine shop turnings	2.50 to 2.75
Bundled skeleton, long	5.50 to 5.75
Forge flashings	5.50 to 5.75
Mixed borings and turnings	1.00 to 1.50
Shafting	12.00 to 12.50
Steel car axles	11.50 to 12.00
Cast iron borings, chemical	6.50 to 7.00
Stove plate	4.00 to 4.25

Per gross ton delivered consumers' yards:

Textile cast	$9.00 to $9.50
No. 1 machinery cast	9.00 to 9.50
Stove plate	6.00 to 6.50
Railroad malleable	11.00 to 11.50

* Delivered local army base.

NEW YORK

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	*$8.50 to †$9.50
No. 2 heavy melting steel	*7.50 to †8.00
Heavy breakable cast	6.75 to 7.25
No. 1 machinery cast	7.50 to 8.00
No. 2 cast	6.50 to 7.00
Stove plate	6.00 to 6.50
Steel car axles	12.50 to 13.00
No. 1 railroad wrought	7.50 to 8.00
No. 1 yard wrought, long	6.50 to 7.00
Spec. iron and steel pipe	4.50 to 5.00
Forge fire	5.50 to 6.00
Rails for rolling	9.00 to 9.50
Short shoveling turnings	2.50 to 3.00
Machine shop turnings	2.50 to 3.00
Cast borings	3.50 to 3.75
No. 1 blast furnace	2.00 to 2.50
Cast borings (chemical)	11.00 to 11.50
Unprepared yard iron and steel	4.50 to 5.00

Per gross ton, delivered local foundries:

No. 1 machinery cast	$10.50
No. 1 hvy. cast (cupola size)	9.50
No. 2 cast	8.00

*For direct car loading only.
†Loading on barge.

BIRMINGHAM

Per gross ton delivered consumers' yards:

Heavy melting steel	$9.00 to $9.50
Scrap steel rails	10.00 to 10.50
Short shoveling turnings	.... 7.00
Stove plates	.... 7.00
Steel axles	.... 11.50
Iron axles	.... 11.50
No. 1 railroad wrought	.... 7.00
Rails for rolling	.... 12.50
No. 1 cast	9.50 to 10.00
Tramcar wheels	.... 10.00
Cast iron borings, chem.	.... 8.00

ST. LOUIS

Per gross ton delivered consumers' yards:

Selected heavy steel	$8.75 to $9.25
No. 1 heavy melting	8.50 to 9.00
No. 2 heavy melting	7.50 to 8.00
No. 1 locomotive tires	9.75 to 10.25
Misc. stand-sec. rails	10.00 to 10.50
Railroad springs	11.00 to 11.50
Bundled sheets	6.00 to 6.50
No. 2 railroad wrought	8.50 to 9.00
No. 1 busheling	5.00 to 5.50
Cast iron borings and shoveling turnings	4.00 to 4.50
Rails for rolling	10.75 to 11.25
Machine shop turnings	4.00 to 4.50
Heavy turnings	5.50 to 6.00
Steel car axles	13.50 to 14.00
Iron car axles	15.00 to 16.00
No. 1 railroad wrought	7.50 to 8.00
Steel rails less than 3 ft.	11.75 to 12.25
Steel angle bars	9.50 to 10.00
Cast iron carwheels	8.00 to 8.50
No. 1 machinery cast	9.00 to 9.50
Railroad malleable	10.00 to 10.50
No. 1 railroad cast	9.00 to 9.50
Stove plate	6.50 to 7.00
Agricult. malleable	8.50 to 9.00

DETROIT

Dealers' buying prices per gross ton:

Heavy melting steel	$7.50 to $8.00
Borings and short turnings	4.25 to 4.75
Long turnings	$3.50 to $4.00
No. 1 machinery cast	10.25 to 10.75
Automotive cast	10.75 to 11.25
Hydraul. comp. sheets	7.50 to 8.00
Stove plate	6.50 to 7.00
New factory busheling	6.50 to 7.00
Old No. 2 busheling	4.25 to 4.75
Sheet clippings	5.50 to 6.00
Flashings	7.25 to 7.75
Low phos. plate scrap	8.25 to 8.75

CANADA

Dealers' buying prices per gross ton:

	Toronto	Montreal
Heavy melting steel	$7.00	$7.00
Rails scrap	8.00	8.00
Machine shop turnings	3.00	3.00
Boiler plate	4.50	4.50
Heavy axle turnings	4.50	4.50
Cast borings	4.00	3.50
Steel borings	2.00	2.00
Wrought pipe	3.50	3.50
Steel axles	7.00	8.00
Axles, wrought iron	7.00	8.00
No. 1 machinery cast	9.00	9.00
Stove plate	5.50	5.00
Standard carwheels	7.25	7.00
Malleable	6.75	7.00

ORES, FLUORSPAR, COKE, FUEL, REFRACTORIES

Lake Superior Ores

Delivered Lower Lake Ports

	Per Gross Ton
Old range, Bessemer, 51.50% iron	$4.80
Old range, non-Bessemer, 51.50% iron	4.65
Mesabi, Bessemer, 51.50% iron	4.65
Mesabi, non-Bessemer, 51.50% iron	4.50
High phosphorus, 51.50% iron	4.40

Foreign Ore

C.i.f. Philadelphia or Baltimore

	Per Unit
Iron, low phos., copper free, 55 to 58% iron, dry Spanish or Algeria	9.50c.
Iron, low phos., Swedish, average 68½% iron	9.50c.
Iron, basic or foundry, Swedish, aver. 65% iron	9c.
Iron, basic or foundry, Russian, aver. 65% iron	9c.
Manganese, Caucasian, washed 52%	26c.
Manganese, African, Indian, 44-48%	21c.
Manganese, African, Indian, 49-51%	24c.
Manganese, Brazilian, 46 to 48½%	20c.

	Per Net Ton Unit
Tungsten, Chinese, wolframite, duty paid, delivered*	$17.50 to $18.50
Tungsten, domestic scheelite, delivered†	17.00

	Per Gross Ton
Chrome, 45%, Cr_2O_3, crude, c.i.f. Atlantic Seaboard	$17.00
Chrome, 48%, Cr_2O_3, c.i.f. Atlantic Seaboard	20.00

*Quotations nominal in absence of sales.
†Nominal; no supplies available.

Fluorspar

	Per Net Ton
Domestic, washed gravel, 85-5, f.o.b. Kentucky and Illinois mines for all-rail shipment	$15.50 to $16.00
Same grade for Ohio River barge shipment for Kentucky and Illinois River landings	17.50
No. 2 lump, 85-5, f.o.b. Kentucky and Illinois mines	$15.50 to 16.00
Foreign, 85% calcium fluoride, not over 5% silicon, c.i.f. Atlantic ports, duty paid	19.00
Domestic, No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	30.00

COKE, COAL AND FUEL OIL

Coke

	Per Net Ton
Furnace, f.o.b. Connellsville Prompt	$3.85
Foundry, f.o.b. Connellsville Prompt	$4.60 to 5.10
Foundry, by-product, Chicago ovens, for delivery outside switching district	8.50
Foundry, by-product, delivered in Chicago switching district	9.25
Foundry, by-product, New England, delivered	11.00
Foundry, by-product, Newark or Jersey City, del'd	8.20 to 8.81
Foundry, by-product, Phila.	9.00
Foundry, by-product, Cleveland, delivered	$9.25
Foundry, Birmingham	6.00
Foundry, by-product, St. Louis, f.o.b. ovens	8.00
Foundry, by-product, del'd St. Louis	9.00

Coal

	Per Net Ton
Mine run steam coal, f.o.b. W. Pa. mines	$1.80 to $2.05
Mine run coking coal, f.o.b. W. Pa.	2.05 to 2.25
Gas coal, ¾-in., f.o.b. Pa. mines	2.25 to 2.55
Mine run gas coal, f.o.b. Pa. mines	2.05 to 2.45
Steam slack, f.o.b. W. Pa. mines	1.55 to 1.65
Gas slack, f.o.b. W. Pa. mines	1.90 to 2.10

Fuel Oil

Per Gal. f.o.b. Bayonne, N. J.	
No. 3 distillate	4.00c.
No. 4 industrial	3.50c.

Per Gal. f.o.b. Baltimore	
No. 3 distillate	4.00c.
No. 4 industrial	3.50c.

Per Gal. del'd Chicago	
No. 3 industrial fuel oil	3.88c.
No. 5 industrial fuel oil	3.38c.

Per Gal. f.o.b. Cleveland	
No. 3 distillate	5.50c.
No. 4 industrial	5.25c.
No. 5 industrial	4.00c.

REFRACTORIES

Fire Clay Brick

	Per 1000 f.o.b. Works High-heat Duty Brick	Intermediate Duty Brick
Pennsylvania	$45.00	$40.00
Maryland	45.00	40.00
New Jersey	55.00	45.00
Ohio	45.00	40.00
Kentucky	45.00	40.00
Missouri	45.00	40.00
Illinois	45.00	40.00
Ground fire clay, per ton	7.00	

Chrome Brick

	Per Net Ton
Standard size	$45.00

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$45.00
Chicago	50.00
Birmingham	55.00
Silica clay, per ton	8.00

Magnesite Brick

	Per Net Ton
Standard size, burned, f.o.b. Baltimore and Chester, Pa.	$65.00
Unburned, f.o.b. Baltimore	55.00
Imported grain magnesite, f.o.b. Baltimore and Chester, Pa.	45.00
Domestic grain magnesite, f.o.b. Baltimore and Chester, Pa.	40.00
Domestic, f.o.b. Chewelah, Wash.	22.00

Warehouse Prices for Steel Products

PITTSBURGH

	Base per Lb.
Plates	3.15c.
Structural shapes	3.15c.
Soft steel bars and small shapes	2.90c.
Reinforcing steel bars	2.90c.
Cold-finished and screw stock:	
Rounds and hexagons	*3.45c.
Squares and flats	*3.45c.
Hoops and bands under ¼ in.	3.20c.
Hot-rolled annealed sheets (No. 24), 25 or more bundles	3.30c.
Galv. sheets (No. 24), 25 or more bundles	3.95c.
Hot-rolled sheets (No. 10)	2.95c.
Galv. corrug. sheets (No. 28), per square (more than 3750 lb.)	$3.69
Spikes, large	2.90c.
Track bolts, all sizes, per 100 count,	65 per cent off list.
Machine bolts, 100 counts,	65 per cent off list.
Carriage bolts, 100 count,	65 per cent off list.
Nuts, all styles, 100 count,	65 per cent off list.
Large rivets, base per 100 lb.	$3.50
Wire, black, soft ann'l'd, base per 100 lb.	*2.70
Wire, galv. soft, base per 100 lb.	*2.925
Common wire nails, per keg	*2.834
Cement coated nails, per keg	*2.834

On plates, structurals, bars, reinforcing bars, bands, hoops and blue annealed sheets, base applies to orders of 400 to 9999 lb.

*Delivered in Pittsburgh switching district.

CHICAGO

	Base per Lb.
Plates and structural shapes	3.20c.
Soft steel bars	2.95c.
Cold-fin. steel bars:	
Rounds and hexagons	3.50c.
Flats and squares	3.50c.
Hot-rolled strip	3.30c.
Hot-rolled annealed sheets (No. 24)	3.85c.
Galv. sheets (No. 24)	4.55c.
Hot-rolled sheets (No. 10)	3.05c.
Spikes (keg lots)	3.50c.
Track bolts (keg lots)	4.65c.
Rivets, structural (keg lots)	3.65c.
Rivets, boiler (keg lots)	3.75c.
	Per Cent Off List
Machine bolts	60 and 5
Carriage bolts	60 and 5
Lag screws	60 and 5
Hot-pressed nuts, sq. tap. or blank	60 and 5
Hot-pressed nuts, hex. tap or blank	60 and 5
Hex. head cap screws	80
Cut point set screws	70 and 10
Flat head bright wood screws	37½ and 10
Spring cotters	50
Stove bolts in full packages	70
Rd. hd. tank rivets, 7/16 in. and smaller	57½
Wrought washers	$4.50 off list
No. 8 black ann'l'd wire per 100 lb.	$3.85
Com. wire nails, base per keg	3.05
Cement c't'd nails, base per keg	3.05

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. All prices are f.o.b. consumers' plants within the Chicago switching district.

NEW YORK

	Base per Lb.
Plates, ¼ in. and heavier	3.40c.
Structural shapes	3.37c.
Soft steel bars, small shapes	3.22c.
Iron bars	3.22c.
Iron bars, swed. charcoal	6.75c. to 7.25c.
Cold-fin. shafting and screw stock:	
Rounds and hexagons	3.92c.
Flats and squares	4.42c.
Cold-rolled; strip, soft and quarter hard	3.32c.
Hoops	3.52c.
Bands	3.52c.
Hot-rolled sheets (No. 10)	3.27c.
Hot-rolled ann'l'd sheets (No. 24*)	3.85c.
Galvanized sheets (No. 24*)	4.56c.
Long terne sheets (No. 24)	5.20c.
Standard tool steel	11.00c.
Wire, black annealed (No. 10)	3.25c.
Wire, galv. (No. 10)	3.85c.
Tire steel, 1 x ⅜ in. and larger	3.65c.
Open hearth spring steel	4.00c. to 10.00c.
Common wire nails, base, per keg	$3.21
	Per Cent Off List
Machine bolts, cut thread: All diameters	70
Carriage bolts, cut thread: All diameters	70
	Per 100 Ft.
Boiler tubes: Lap welded, 2-in.	$18.05
Seamless welded, 2-in.	19.24
Charcoal iron, 2-in.	24.94
Charcoal iron, 4-in.	63.65

*No. 28 and lighter, 36 in. wide, 20c. higher per 100 lb.

ST. LOUIS

	Base per Lb.
Plates and struc. shapes	3.44c.
Bars, soft steel or iron	3.19c.
Cold-fin. rounds, shafting, screw stocks	3.74c.
Hot-rolled annealed sheets (No. 24)	4.09c.
Galv. sheets (No. 24)	4.79c.
Hot-rolled sheets (No. 10)	3.29c.
Black corrug. sheets (No. 24)	4.09c.
*Galv. corrug. sheets	4.79c.
Structural rivets	3.99c.
Boiler rivets	4.09c.
	Per Cent Off List
Tank rivets, 7/16 in. and smaller	55
Machine and carriage bolts, lag screws fittings up bolts, bolt ends, plow bolts, hot-pressed nuts, square and hexagon, tapped or blank, semi-finished nuts: 1000 lb. or over	70 and 10
200 to 999 lb.	67½ and 10
100 to 199 lb.	65 and 10
Less than 100 lb.	60 and 10

*No. 26 and lighter take special prices.

PHILADELPHIA

	Base per Lb.
*Plates, ¼-in. and heavier	2.95c.
*Structural shapes	2.95c.
*Soft steel bars, small shapes, iron bars (except bands)	2.90c.
‡Reinforc. steel bars, sq. twisted and deformed	2.955c.
Cold-finished steel bars	3.75c.
*Steel hoops	3.40c.
*Steel bands, No. 12 and 3/16 in., incl.	3.15c.
Spring steel	5.00c.
†Hot-rolled anneal. sheets (No. 24)	3.55c.
†Galvanized sheets (No. 24)	4.25c.
*Hot-rolled annealed sheets (No. 10)	3.05c.
Diam. pat. floor plates, ¼ in.	4.95c.
Swedish iron bars	6.25c.

These prices are subject to quantity differentials except on reinforcing and Swedish iron bars.

*Base prices subject to deduction on orders aggregating 4000 lb. or over.

†For 50 bundles or over.

‡For less than 2000 lb.

CLEVELAND

	Base per Lb.
Plates and struc. shapes	3.31c.
Soft steel bars	2.95c.
Reinforc. steel bars	*2.10c.
Cold-finished steel bars	3.40c.
Flat-rolled steel under ¼ in.	3.36c.
Cold-finished strip	3.00c.
Hot-rolled annealed sheets (No. 24)	3.96c.
Galvanized sheets (No. 24)	4.61c.
Hot-rolled sheets (No. 10)	3.11c.
Hot-rolled 3/16 in. 24 to 48 in. wide sheets	3.56c.
Black ann'l'd wire, per 100 lb.	$2.65
No. 9 galv. wire, per 100 lb.	3.00
Com. wire nails, base per keg	2.40

*Plus mill, size and quantity extras.

†Outside delivery 10c. less.

CINCINNATI

	Base per Lb.
Plates and struc. shapes	3.40c.
Bars, soft steel or iron	3.15c.
Nev. billet reinforc. bars	3.25c.
Rail steel reinforc. bars	3.25c.
Hoops and bands, 3/16 in. and lighter	3.45c.
Cold-finished bars	3.75c.
Hot-rolled annealed sheets (No. 24)	4.00c.
Galv. sheets (No. 24)	4.70c.
Hot-rolled sheets (No. 10)	3.20c.
Structural rivets	4.35c.
Small rivets	55 per cent off list
No. 9 ann'l'd wire, per 100 lb. (1000 lb. or over)	$2.91
Com. wire nails, base per keg: 1 to 24 kegs	3.50
25 to 50 kegs	3.30
Large quantities	3.10
Cement c't'd nails, base 100-lb. keg	3.50
Chain, 1-in., per 100 lb.	8.35
	Net per 100 Ft.
Seamless steel boiler tubes, 2-in.	$19.03
4-in.	44.96
Lap-welded steel boiler tubes, 2-in.	18.10
4-in.	42.32

BUFFALO

	Base per Lb.
Plates	3.37c.
Struc. shapes	3.25c.
Soft. steel bars	3.00c.
Reinforcing bars	2.60c.
Cold-fin. flats and sq.	3.55c.
Round and hex.	3.55c.
Cold-rolled strip steel	3.19c.
Hot-rolled annealed sheets (No. 24)	4.05c.
Heavy hot-rolled sheets, 3/16 in., 24 to 48 in. wide	3.62c.
Galv. sheets (No. 24)	4.70c.
Bands	3.42c.
Hoops	3.42c.
Hot-rolled unannealed sheets	3.17c.
Com. wire nails, base per keg	$3.35
Black wire, base per 100 lb.	3.55

BOSTON

	Per Lb. Base
Beams, channels, angles, tees, zees	3.52c.
H beams and shapes	3.52c.
Plates—sheared, tank and univ. mill, ¼ in. thick and heavier	3.53c.
Floor plates, diamond pattern	5.33c.
Bar and bar shapes (mild steel)	3.30c.
Bands 3/16 in. thick and No. 12 ga. incl.	3.60c. to 4.60c
Half rounds, half ovals, ovals and bevels	4.55c.
Tire steel	4.55c.
Cold-finished rounds, squares and hexagons	4.00c.
Cold-rolled strip steel	3.245c.
Cold-finished flats	3.85c.
Blue annealed sheets, No. 10 gal.	3.60c.
One pass cold-rolled sheets No. 24 ga.	4.15c.
Galvanized steel sheets, No. 24 ga.	4.85c.
Lead coated sheets, No. 24 ga.	5.80c.

Prices delivered by truck in metropolitan Boston, subject to quantity differentials.

MILWAUKEE

	Base per Lb.
Plates and structural shapes	3.31c.
Soft steel bars	3.06c.
Hot-rolled strip	3.41c.
Hot-rolled sheets (No. 10)	3.16c.
Hot-rolled annealed sheets (No. 24)	3.96c.
Galvanized sheets (No. 24)	4.66c.
Cold-finished steel bars	4.36c.
Cold-rolled strip	3.30c.
Structural rivets (keg lots)	3.86c.
Boiler rivets (keg lots)	3.96c.
Track spikes (keg lots)	3.71c.
Track bolts (keg lots)	4.86c.
Black annealed wire	3.10c.
Com. wire nails	2.90c.
Cement coated nails	2.90c.
	Per Cent Off List
Machine bolts (100 pcs. and over)	70
Carriage bolts (100 pcs. and over)	70
Hot-pressed nuts, sq. and hex., tapped or blank (keg lots)	60 and 5

Prices given above are delivered Milwaukee.

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. On galvanized and No. 24 hot-rolled annealed sheets the prices given apply on orders of 400 to 3499 lb. On cold-finished bars the prices are for orders of 300 to 499 lb.

PACIFIC COAST

	Base per Lb. San Francisco	Los Angeles	Seattle
Plates, tank and U. M.	3.55c.	3.70c.	3.55c.
Shapes, standard	3.55c.	3.70c.	3.55c.
Soft steel bars	3.60c.	3.70c.	3.60c.
Reinforcing bars	3.50c.	3.50c.	3.50c.
Hot-rolled annealed sheets (No. 24)	4.40c.	4.45c.	4.40c.
Hot-rolled sheets (No. 10)	3.75c.	3.80c.	3.75c.
Galv. sheets (No. 24)	5.00c.	5.05c.	5.00c.
Cold finished steel: Rounds	5.95c.	5.95c.	4.75c.
Squares and hexagons	7.20c.	7.20c.	6.00c.
Flats	7.70c.	7.70c.	7.00c.
Common wire nails —base per keg less carload	$3.40	$3.25	$3.30

All items subject to differentials for quantity.

TOOL STEEL

Prices are same for warehouse distribution at all points on or East of Mississippi River. West of Mississippi quotations are 1c. a lb. nigher.

	Base per Lb.
High speed	57c.
High carbon chrome	37c.
Oil hardening	22c.
Extra	17c.
Regular	14c.

Construction More Active on Coast

SAN FRANCISCO, Feb. 25.—Continued improvement in business activity on the Pacific Coast is reflected in construction awards. Soule Steel Co. is reported to have booked 3335 tons of reinforcing bars for use on the San Francisco viaduct and approaches of the Trans-Bay bridge. This tonnage had been pending for nearly two months. Concrete Engineering Co. was the successful bidder on 508 tons of bars for two dams near San Jose, Cal.

Structural lettings, aggregating 2481 tons, were topped by 850 tons of structural tunnel supports for the Metropolitan Water District at Los Angeles, which was placed with the Consolidated Steel Corpn. At Tacoma, Wash., the contract for the 42-in. unit of the Green River pipe line, involving 756 tons of plates, was awarded to the Puget Sound Machinery Depot.

Bids have been opened at Fresno, Cal., for a city auditorium in which 460 tons of reinforcing bars and 400 tons of structural steel are specified. The Marina Junior High School in San Francisco, on which bids are under advisement, will require 635 tons of bars and 600 tons of shapes. Plans are being prepared at Denver, Colo., for a retarding dam in Cherry Creek, calling for 415 tons of reinforcing bars.

The movement in Congress for increased appropriations for fortifying and strengthening Army and Navy bases points to extensive construction in this section of the country. The Coast States, with their improved highway systems, are interested in the contemplated Federal grade crossing elimination program.

Tin Prices Drop to Lowest Level Since October, 1933—Zinc Rises

Copper Buying Well Sustained With Month's Sales Almost Up to Code Quota—Lead Statistics Favorable, But Market Continues Dull

NEW YORK, Feb. 26.—With February copper sales through yesterday having amounted to 26,200 tons, it seems likely that the month's total may reach the industry's monthly "book" under the code of 30,000 tons. Yesterday's transactions amounted to 1400 tons and no recession in demand seemed imminent. Sellers believe that increased buying this month has been due entirely to the greater activity of fabricators who have largely used up the stocks they accumulated before the code became effective. The Blue Eagle price is unchanged at 9c. a lb., Connecticut Valley, but prices abroad have fallen off sharply in the last week. At London this morning, electrolytic copper was quotable at 6.42½c. to 6.50c. a lb., usual Continental base ports. This represents a decline of at least 30 points, as compared with one week ago.

Lead

Despite the publication of favorable January statistics, the lead market remains rather dull. Sales yesterday were in fair volume, but little business is before the trade this morning, and significant March buying is still being postponed. Corroders and battery makers have placed a little March business. The price situation is unchanged, with most sellers quoting 3.40c. a lb., St. Louis, and 3.55c., New York. One large interest continues to sell in the East at $1 a ton premium. The lead ore market is also steady at $33 a ton. Lead stocks declined about 3500 tons during January, standing at 231,993 tons at the end of the month. Production dropped to 30,674 tons from 37,217 tons in December, while shipments, at 34,164 tons, reflected little change from the 34,680 tons moved in December.

Tin

Further sharp declines in tin prices abroad have naturally been reflected in the market here which has fallen 2½c. a lb. in the last week. The quotation today of 47.87½c. for spot Straits metal is the lowest since October, 1933. The action of the London market is attributable entirely to the withdrawal of pool support, following the pepper and shellac failures, and the recent decline has taken place without the benefit of heavy selling. The market is apparently merely seeking its own level, and there is no reason to believe that that level has yet been reached. In the New York market a little buying has taken place on the decline, but as the sharpest drop in London occurred on Friday when the New York market was closed, consumers have not had much opportunity to express themselves. It is believed, however, that current purchases are being confined to actual spot needs. Standard tin was quoted in London today at £214 15s. for spot, and £212 10s. for futures. Straits metal was available in London at £216 15s., while the Eastern market was quotable at £219 2s. 6d.

Zinc

Leading sellers advanced prices 50c. a ton yesterday for February metal and $1 a ton for March delivery. The market today seems to be fairly well established at the higher level, and is quotable at 4.10c. a lb., New York, and 3.75c., East St. Louis, for Prime Western. The reaction of the trade to the advance is not yet clearly defined and demand today has been rather listless. Sales last week, however, amounted to nearly 4000 tons, compared with only 1600 tons in the week before. The price advance is generally interpreted as meaning that producers have come to some understanding regarding curtailment. No details are forthcoming, but it is believed to be impossible to get prices up to a profitable level unless output is better adjusted to consumption. Ore prices are unchanged at $25 a ton for flotation and $26 for mill grades. Sales last week amounted to 5000 tons against shipments of 8900 tons and production of 8700 tons.

The Week's Prices. Cents Per Pound for Early Delivery

	Feb. 20	Feb. 21	Feb. 22	Feb. 23	Feb. 25	Feb. 26
Electrolytic copper, N. Y. *	8.75	8.75	...	8.75	8.75	8.75
Lake copper, N. Y.	9.12½	9.12½	...	9.12½	9.12½	9.12½
Straits tin, Spot, New York	50.35	49.85	...	..	48.15	47.87½
Zinc, East St. Louis	3.70	3.70	...	3.70	3.72½	3.75
Zinc, New York	4.05	4.05	...	4.05	4.07½	4.10
Lead, St. Louis	3.40	3.40	...	3.40	3.40	3.40
Lead, New York	3.55	3.55	...	3.55	3.55	3.55

*Refinery quotations; price ¼c. higher delivered in Connecticut.

Aluminum, virgin 99 per cent plus, 19c. to 22c. a lb., delivered.
Aluminum, remelt No. 12 (alloy), carload lots delivered, 14c. a lb., average for week.
Nickel electrolytic cathode, 35c. a lb., delivered; shot and ingot, 36c. a lb., delivered.
Antimony, 14.50c. a lb., New York.
Brass ingots, 85-5-5-5, 8.25c. a lb., New York and Philadelphia.

From New York Warehouse

Delivered Prices, Base per Lb.

Tin, Straits pig	49.75c. to 50.75c.
Tin, bar	51.75c. to 52.75c.
Copper, Lake	10.25c. to 11.00c.
Copper, electrolytic	10.00c. to 10.50c.
Copper, castings	9.75c. to 10.75c.
*Copper sheets, hot-rolled	16.00c.
*High brass sheets	14.25c.
*Seamless brass tubes	16.00c.
*Seamless copper tubes	16.25c.
*Brass rods	12.75c.
Zinc, slabs	5.75c. to 6.75c.
Zinc, sheets (No. 9), casks, 1200 lb. and over	10.25c.
Lead, American pig	4.50c. to 5.50c.
Lead, bar	5.50c. to 6.50c.
Lead, sheets	7.25c.
Antimony, Asiatic	15.50c. to 16.50c.
Alum., virgin, 99 per cent, plus	23.30c.
Alum., No. 1 for remelting, 98 to 99 per cent	18.00c. to 19.00c.
Solder, ½ and ½	30.00c. to 31.00c.
Babbitt metal, commercial grades	25.00c. to 60.00c.

*These prices are also for delivery from Chicago and Cleveland warehouses.

From Cleveland Warehouse

Delivered Prices per Lb.

Tin, Straits pig	52.00c.
Tin, bar	54.00c.
Copper, Lake	10.00c.
Copper, electrolytic	10.00c.
Copper, castings	9.75c.
Zinc, slabs	5.50c. to 5.75c.
Lead, American pig	4.50c. to 4.75c.
Lead, bar	7.75c.
Antimony, Asiatic	16.50c.
Babbitt metal, medium grade	18.50c.
Babbitt metal, high grade	57.00c.
Solder, ½ and ½	31.75c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators, and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	5.37½c.	6.12½c.
Copper, hvy. and wire	5.25c.	5.75c.
Copper, light and bottoms	4.25c.	4.75c.
Brass, heavy	2.75c.	3.37½c.
Brass, light	2.00c.	2.75c.
Hvy. machine composition	4.37½c.	4.87½c.
No. 1 yel. brass turnings	3.62½c.	4.12½c.
No. 1 red brass or compos. turnings	3.87½c.	4.37½c.
Lead, heavy	2.62½c.	3.00c.
Zinc	1.87½c.	2.25c.
Cast aluminum	9.62½c.	10.75c.
Sheet aluminum	11.00c.	12.50c.

Pipe Lines

Virginia Electric & Power Co., Richmond, Va., plans steel pipe line for gas service in Norfolk, Va., district, to be submerged in Eastern branch of Elizabeth River, replacing present pipe line.

Dickey Oil & Refining Co., Wichita, Kan., plans welded steel pipe line from Chindberg, Kan., oil field district to Lindsborg, Kan., about 14 miles, for crude oil.

Associated Oil Co., 79 New Montgomery Street, San Francisco, has purchased control of Associated Pipe Line Co., through acquisition of two-thirds interest heretofore held by Southern Pacific Co. and Standard Oil Co. of California, respectively. Acquired company operates a 590-mile pipe line system in State, which will be extended by Associated company in connection with 1935 expansion program. Fund of $530,000 has been authorized for transportation facilities, considerable part of appropriation to be used for steel pipe construction.

Parowan, Utah, plans 6300 ft. steel pipe line for penstock service for municipal hydroelectric power plant, replacing present woodstave line. Cost about $25,000; also will install cast iron pipe for water system, replacing existing woodstave pipe. Financing has been arranged. Caldwell & Richards, Templeton Building, Salt Lake City, Utah, are consulting engineers.

Tacoma, Wash., has low bid from Puget Sound Machinery Depot, Seattle, for 42-in. welded steel pipe line (Section N, Green River Gravity Pipe Line System), at $108,011.

Public Utilities Commission, City Hall, San Francisco, closes bids March 6 for 54-in. steel submarine pipe, comprising double line, each 2800 ft. long, for submerged portion of bay crossing pipe line system in San Francisco Bay at Dumbarton Strait.

General Petroleum Corpn., Los Angeles, subsidiary of Socony Vacuum Oil Co., Inc., New York, is inquiring for about 7900 tons of 10¾-in. o.d. seamless pipe for an 88-mile line in California.

Elyria, Ohio, will ask for bids soon on 16,000 ft. of 30-in. pipe, 1100 tons, for a new water main from city to its pumping station on Lake Erie at Lorain, Ohio.

Cast Iron Pipe

Cordova, Md., plans water pipe lines. Fund of about $41,000 will be arranged for this and other waterworks construction.

Alma, Colo., plans pipe line for water system. Special election is being arranged to approve bond issue of $25,000 for this and other waterworks installation. E. Harrison Thwaits, 357 Lafayette Street, Denver, is consulting engineer.

Lompoc, Cal., plans trunk water pipe line in Lafayette Square district, replacing smaller mains. Cost about $20,000; also will install new pumping stations. E. A. Vaughn is city manager.

Woodville, Miss., closes bids March 5 for quantity 3-in. for water supply.

Tom Bean, Tex., will soon ask bids for about 4700 ft. of 6 and 8-in. for water supply; also for 50,000-gal. elevated tank and tower, pumping machinery and other waterworks equipment. D. C. Walmsley, Thomas Building, Dalias, Tex., is consulting engineer.

Burlingame Road Water Co., Herman Zinn, RFD No. 10, Topeka, Kan., head, plans about 9000 ft. of 4-in. for water system in part of district. H. L. Brosius, RFD No. 10, Topeka, is consulting engineer.

Bainville, Mont., plans 13,540 ft. of 4 to 8-in. for water supply; also pumping plant and other waterworks equipment. Fund of $34,000 has been secured through Federal aid. Roy N. Stewart, 602 West Babcock Street, Bozeman, Mont., is consulting engineer.

Manchester, Mass., plans pipe lines for extensions in water system. Cost over $25,000. Appropriation has been authorized.

Glenora, N. D., plans water pipe lines. Fund of $50,000 is being arranged for this and other waterworks construction.

Tilghman, Md., plans pipe line for water system. It is proposed to arrange appropriation of $47,000 for this and other waterworks installation.

Celoron, N. Y., plans pipe lines in number of streets in Ellicott Township for extensions in water system. L. L. Graham, Jamestown, N. Y., is engineer.

Blue Mountain, Miss., plans water pipe lines. Fund of $30,000 is being arranged for this and other waterworks installation.

Aurora, Ill., will soon take bids for pipe for extensions in water system; also for 1,500,000-gal. elevated steel tank on 69-ft. steel tower, with new 16-in. pipe line for connection witth trunk water main in Ohio Street, and other waterworks equipment. Cost about $80,000. Walter E. Deuchler is city engineer.

Chicago will open bids March 5 on 3200 tons of 20 to 54-in.

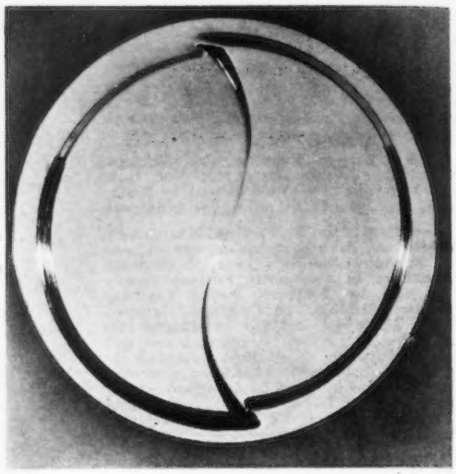
Belmont, Cal., has awarded 325 tons of 4 to 8-in. to American Cast Iron Pipe Co.

Beverly Hills, Cal., has taken bids on 111 tons of 6 and 8-in.

Tillamook, Ore., has received a $59,000 PWA grant for replacement of 32,000 ft. of steel water mains.

Coquille, Ore., has received a loan of $35,000 from PWA for replacement of four miles of existing pipe line.

THE older type of Hupmobile hub cap with the initial was redesigned along more simple lines. The result is greater individuality and a 50 per cent reduction in manufacturing cost.



Attractive Finish Helps Metal Products Sales

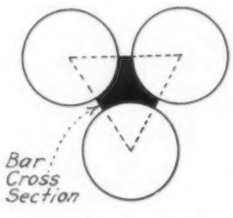
(CONTINUED FROM PAGE 25)

they could then turn over to their own engineering department, where construction details would be solved. They expected to pay about $1,500, but Mr. Geddes explained that his function was far more basic than merely making pictures. He said the job would probably cost $50,000 and would take a year.

Eventually he got the job, and his first action was to place a competent engineer in the manufacturer's plant and to send other engineers out into the field to find out what competitors were doing and also to gather material on what the ultimate consumer really wanted in a stove. The report on this investigation was a 300-page volume and the result of Mr. Geddes' work was an entirely new kind of stove which immediately created a demand fully justifying the manufacturer's courage in turning to the designer.

In speaking of the close relationship between the designer and the manufacturer, Mr. Deskey has said: "The mass production of quickly fabricated parts has directed attention to the elimination of useless ornament as well as to the necessity for close and intelligent collaboration in avoiding obstacles to manufacture. In this country, due to the broadcasting of every new idea through our numerous agencies of circulation and due to the scale upon which our industry operates, manufacturers have a tremendous power to affect the public taste with, of course, the danger of affecting it for the worse. While this danger was real and menacing when the modern style first started, the objectionable features are now less pronounced and methods of mass production will not permit the haphazard accidents of the past."

Even assuming a thorough knowledge of metals and processes on the part of the designer, his work is far from easy or from assurance of success in every case. A big uncertain item which enters into any new development is the reaction of the public, and underlying this reaction is the peculiar psychological factor described rather vaguely as style or vogue. However attractive an article may be, as soon as the impression gains headway among consumers that it is out of style the demand drops off and obsolescence may become a factor just as surely as it does in production equipment when more efficient units are placed on the market. In other words, a manufacturer of, say, an automobile lamp faces the possibility of obsolescence in two quarters—in the equipment which he uses to make the lamp and in the lamp itself.

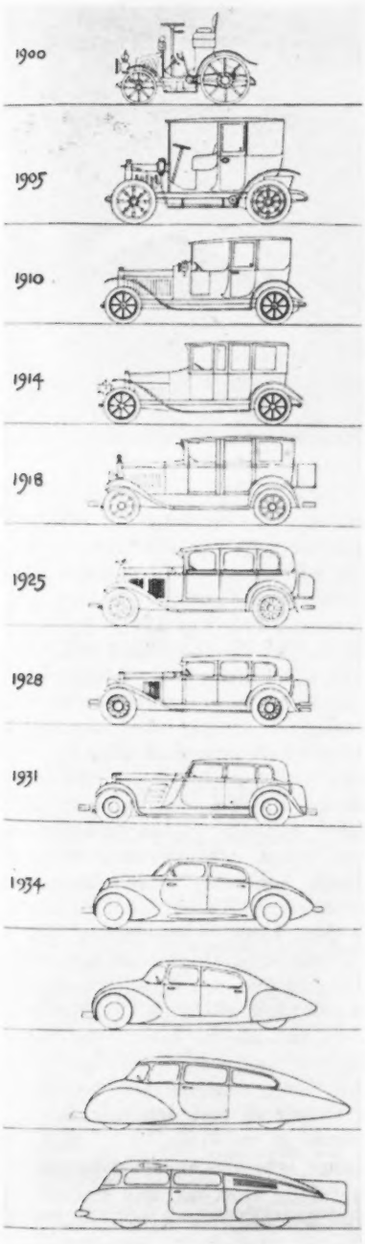


THE shaded portion is the cross section of an aluminum bar which is used by Donald Deskey as an attractive standard for tables, lamps, and other items of furniture.

The comparatively small manufacturer of metal products which are sold direct to the public may not be able to engage the services of an independent designer but, nevertheless, there is much that he may do to give his product greater sales value. For one thing, he can have his engineers study the characteristics of the many metal products which already are enjoying active sales. Many basic features found in these, such as simplicity of outline, color, character of finish, and nature of materials, often may be adapted to the design of an entirely new product. Another means open to any manufacturer for determining the probable attitude of the public is that of trial and error. If, for instance, the product in question is an adding machine, units embodying several different forms and finishes may be prepared and the relative demand tested. Sales advisers have made many tests to determine what people are apt to choose and while, for the most part, these tests have been made in connection with such

items as textiles and trimmings for women's clothes, some of the results may be transferred to the metal industry.

Bright colors will gain first attention, but care must be taken to prevent bizzare effects as the general mass taste tends toward conservatism. At the automobile show people will be attracted by a glossy cream-colored car, but when it comes to actual buying, most people prefer a more subdued color scheme. Nevertheless, colors are vitally important in the design of most any metal product and in some cases merely the changing of a color will spell the difference between profit and loss. An example of this is illustrated by the massage roller designed by Mr. Loewy. Of the two rollers shown in accompanying photographs, the chief distinction is one of color. The light-colored roller developed an increase in sales of 120 per cent.



IN designing for the future it is necessary to consider the past and for this purpose Mr. Loewy has prepared this interesting study in the evolution of the automobile profile.

Color combinations are important, but even here no standards can be set up, for what may seem to be discordant colors one year are accepted quite generally another year. However, it is well for the manufacturer to know some of the underlying principles of color harmony, some of which were outlined in the 18th article of the present series on metal finishing, which appeared in THE IRON AGE

THE new idea in use of standard metal forms in furniture is illustrated by this early Deskey design.

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SQUARE tubing is ingeniously used in many types of furniture. This shows a design of table in which advantage is taken of the greater strength of metal. Two legs give ample rigidity.

of May 24, 1934. Next to color comes form in determining the sales appeal. Psychologists tell us that people like to buy things which they think would feel good in their hands, even though the item in question may be a curtain bracket which, once up, will never be handled. This factor determines such things as rounded corners, matte finish, curved outline, and absence of gingerbread.

Products Should Sell Themselves

In the close industrial competition of today products must be made as far as possible to sell themselves, and here is where proper design contributes its greatest commercial value. It reduces the cost of selling. Contrariwise, mistakes in design may be very expensive. This was discovered some years ago in the radio industry, where expensive and elaborate designing along unfortunate channels caused losses running into hundreds of thousands of dollars. Novelty is also an important factor in design, but this does not imply that there is merit in the freakish in any sense. On the contrary, it means ingenuity and unexpected simplicity. An excellent example is Mr. Loewy's interesting redesigning of a Hupmobile hub cap. The old and new caps are shown in an accompanying illustration. Here the motive behind the redesigning was reduction in cost, but the result achieved was not only a saving in cost, but a great increase in individuality. The new design was accomplished by merely taking a set of plain embossing dies and shifting half of the embossed surface along a pleasing curved dividing line. The saving in production cost as against the old hub cap was more than 50 per cent.

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THIS gas stove, designed for the Standard Gas Equipment Corpn., after a year's study, by Mr. Geddes, has no projections or dirt catching corners. It is finished in ivory white enamel with chromium plated trimmings.

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Fabricated Structural Steel

WITH no awards exceeding 850 tons, bookings total only 6700 tons, compared with 13,500 tons last week. New projects of 8500 tons include 2500 tons for the Ashland Avenue bridge in Chicago and 1400 tons for a bridge at New Tazewell, Tenn., for the Tennessee Valley Authority. Plate lettings total 1460 tons. Structural steel awards for the week follow:

NORTH ATLANTIC STATES

Boston, 410 tons, approaches to the Chelsea highway bridge, to McClintic-Marshall Corpn.

Hartford, Conn., 290 tons, administration building for St. Joseph College, to Standard Structural Steel Co.

Delaware, Lackawanna & Western, 350 tons, railroad bridge at Ogden Street, Newark, N. J., to Phoenix Bridge Co.

De Ruyter, N. Y., 145 tons, high school, to Anthracite Bridge Co.

Camden, N. J., 130 tons, factory building, to Morris Wheeler Co.

Washington, 145 tons, bus terminal, to Barber & Ross Co.

Washington, 100 tons, Eastern Avenue bridge, to McClintic-Marshall Corpn.

THE SOUTH

Lyons, Ga., 160 tons, bridges, to Virginia Bridge & Iron Co.

State of Georgia, 440 tons, bridges at Jackson and Greensboro, to McClintic-Marshall Corpn.

Sheffield, Ala., 203 tons, transmission towers for Tennessee Valley Authority, to Nashville Bridge Co.

CENTRAL STATES

Mahoning County, Ohio, 250 tons, bridge, to Lackawanna Steel Construction Corpn.

Kendall County, Ill., 150 tons, bridge, to A. C. Woods Steel Co., Rockford, Ill.

Jennings County, Ind., 190 tons, bridge, to Brookville Bridge, Co., Brookville, Ohio.

Ottumwa, Iowa, 1600 tons, viaduct, to Wisconsin Bridge & Iron Co.; previously reported as 850 tons.

WESTERN STATES

Idaho County, Idaho, 206 tons, Bureau of Public Roads bridge over Kooskia River, to Pacific Coast Steel Corpn.

Kalispell, Mont., 700 tons, highway bridge, to McClintic-Marshall Corpn.

Boulder City, Nev., 150 tons, gates at power house, to Mississippi Valley Structural Steel Co.

Los Angeles, 850 tons, tunnel ribs for Metropolitan Water District, Specification M-2038, to Consolidated Steel Corpn.

Mare Island, Cal., 800 tons, gantry crane for Navy Yard, to Star Iron & Steel Co.

South Gate, Cal., 100 tons, factory, to Consolidated Steel Corpn.

Los Angeles, 100 tons, alterations to Edison junior high school, to Consolidated Steel Corpn.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

Hartford, Conn., 300 tons, chemistry building for Trinity College.

Brooklyn, 350 tons, addition to school No. 25.

Newfane, N. Y., 225 tons, State highway bridge.

Bayonne, N. J., 700 tons, high school; Bethlehem Fabricators, Inc., low bidder.

Cumberland, Md., 600 tons, high school.

SOUTH AND SOUTHWEST

New Tazewell, Tenn., 1400 tons, bridge for Tennessee Valley Authority.

Edgington, Okla., 400 tons, State highway bridge.

State of Oklahoma, 600 tons, highway bridges; bids opened Feb. 27.

CENTRAL STATES

Cleveland, 305 tons, blower building for Easterly Sewage Disposal plant; Hunkin-Conkey Construction Co. low bidder for general contract and Fort Pitt Bridge Works Co. low bidder for steel.

Chicago, 2500 tons, Ashland Avenue bridge.

Chippewa Falls, Wis., 150 tons, Grand Avenue bridge; bids March 12.

Baraboo, Wis., 500 tons, Lyons bridge; bids soon.

State of Iowa, 375 tons, bridges.

State of Missouri, 650 tons, highway bridges; bids to be opened March 2.

WESTERN STATES

Warm Springs, Mont., 245 tons, hospital bids March 4.

Billings, Mont., 158 tons, high school; bids rejected, new bids soon.

Long Beach, Cal., 190 tons, transit shed on Pier 1; bids soon.

Everett, Wash., 225 tons, bridge.

FABRICATED PLAT

AWARDS

Little Falls, N. J., 120 tons, filter tanks, to Paterson Boiler & Tank Co.

New Orleans, 110 tons, boiler barge, to Gulf Port Welding & Machining Co.

Shawano, Wis., 375 tons, tanks, to Pittsburgh-Des Moines Steel Co.

Tacoma, Wash., 756 tons, Green River pipe line, to Puget Sound Machinery Depot.

Belmont, Cal., 100 tons, two tanks for city, to Western Pipe & Steel Co.

NEW PROJECTS

Paxton, Neb., 400 tons, steel syphon for Pratt Valley Public Power Co.

SHEET PILING

NEW PROJECTS

Oakland, Cal., 130 tons, fender for Park Street bridge; bids under advisement.

Railroad Equipment

Chicago, Burlington & Quincy is building one 4-6-4 type locomotive in its own shops. This railroad has ordered 7000 tons of track accessories.

Delaware River Joint Commission is asking for bids on 26 passenger cars for electric railway service, with four extra trucks. Bids due March 15 to J. K. Costello, secretary of commission at Philadelphia.

Louisiana & Arkansas is inquiring for four locomotives.

Interborough Rapid Transit Co., New York, is in the market for 5000 wheels.

RAILS

Missouri Pacific and subsidiaries have been authorized to expend $5,584,603 for betterments and improvements this year, including the following for rails and other track material: Missouri Pacific, $983,800; Missouri Pacific in Nebraska, $29,200; International-Great Northern, $212,640; New Orleans, Texas & Mexico, $16,510; Beaumont, Sour Lake & Western, $113,900; St. Louis, Brownsville & Mexico, $22,500; San Antonio, Uvalde & Gulf, $15,500; Missouri-Illinois, $11,600, and Houston & North Shore, $200.

Bangor & Aroostook has ordered 1000 tons of rails from Carnegie Steel Co.

Chicago Great Western has applied for Government funds to buy 5000 tons of rails.

Reinforcing Steel

Awards 5000 Tons—New Projects 7225 Tons

AWARDS

New York, 220 tons, New York Central track depression, to an unnamed distributer through P. T. Cox Contracting Co.

State of Illinois, 225 tons, bridges, to an unnamed bidder.

Bayway, N. J., 150 tons, piling, to Concrete Steel Co.

San Francisco, 3335 tons, viaduct and approaches on San Francisco side of Trans-Bay bridge, to Soule Steel Co.

San Jose, Cal., 508 tons, Almaden and Stevens Creek dams, to Concrete Engineering Co.

State of California, 300 tons, five post offices in northern section; to unnamed bidders.

Seattle, 100 tons, Bureau of Public Roads bridge in Mount Rainier Reserve, to an unnamed bidder.

Seattle, 150 tons, city light building, to Morel Foundry Co.

NEW REINFORCING BAR PROJECTS

Dublin, Ohio, 336 tons, highway bridge; bids to be taken by Ohio State Highway Department March 8.

Zanesville, Ohio, 700 tons, for Mohawk dam; bids to be taken by United States Engineers March 19.

Minneapolis, Minn., 445 tons, armory.

Minneapolis, 2000 tons, sewage project.

State of Iowa, 125 tons, bridges.

Paxton, Neb., 1600 tons, for Platte Valley Public Power Co.

Ogden, Utah, 175 tons, city reservoir; bids taken Feb. 26.

Denver, 415 tons, Cherry Creek retarding dam near Sullivan; bids soon.

Phoenix, Ariz., 150 tons, post office.

Los Angeles, 250 tons, Hollywood high school.

Los Angeles, 150 tons, alterations on Edison junior high school.

Los Angeles, 150 tons, chapel at Calvary Cemetery.

Fresno, Cal., 460 tons, city auditorium; Dinwiddie Construction Co. low bidder.

Fresno, Cal., 260 tons, Hall of Records; bids soon.

Republic to Contest Anti-Trust Suit

THE Republic Steel Corpn. will vigorously contest the suit brought by the Department of Justice to enjoin the proposed Republic-Corrigan, McKinney merger, according to a letter to Republic stockholders, authorized by the board of directors and signed by T. M. Girdler, chairman.

OBITUARY

MAX. R. TREMBOUR, director of research and superintendent of electric furnaces, Jessop Steel Co., Washington, Pa., died of pneumonia at the Washington Hospital, on Feb. 15. He was born in Germany 55 years ago and was graduated from the University of Heidelberg. He came to this country just prior to the war. He was long identified with the tool steel and alloy steel industry. Prior to his association with the Jessop company, he had been connected with Ludlum Steel Co., United Alloy Steel Corpn. and Colonial Steel Co.

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J. W. EITING, secretary and treasurer of the Minster Machine Co., Minster, Ohio, vice-president, Streine Tool & Mfg. Co., New Bremen, Ohio, and vice-president, secretary and treasurer of St. Marys Foundry Co., St. Marys, Ohio, died Feb. 20 at his residence in Minster, Ohio, aged 59. He was an organizer of these three companies.

Brittleness in Steel

[CONTINUED FROM PAGE 29]

that it is only detected by fairly slow testing and not by quick fracture. When manganese is added to Armco iron, the oxygen in solution is deoxidized and the allotropic range is lowered, dulled, and widened. The cause of red shortness in Armco iron seems to be due to, as previously stated, oxygen in solution and possibly to transformation shortness. The removal of the oxygen in solid solution removes the main cause of red shortness but does not entirely eliminate it as transformation shortness depends upon allotropism. But the effect of the manganese so weakens it that it is only recorded in slow testing and not in quick working.

Carbon is another element that lowers the allotropic range and consequently will lower the range of transformation shortness. Torsion test results show that the transformation temperature is lowered and narrowed with the increasing carbon content, and lessens the intensification of transformation. These results are in accordance with those obtained by thermal and dilation methods which indicate that the intensity of the A_3 transformation decreases with carbon content and the range is narrowed, lowered, and the intensity of the gamma to alpha or alpha to gamma lessens with the increase of carbon.

Grain size also seems to affect transformation shortness. Large grains appear to resist conversion much more readily than fine grained material and, therefore, dull the transformation effect. Fine crystalline material may transform much quicker than large grained aggregates and will have a tendency to sharpen and narrow the range of transformation shortness.

Loss of ductility due to allotropic transformation has been termed "transformation shortness" in this investigation and appears in various metals that possess this property. It is not a function of slow testing but a physical property of the metal and is brought forth more clearly by slow testing than by fast. Its characteristics may be controlled by two factors, (1) alloying elements, and (2) grain size. The characteristics of the alloying elements determine the transformation range, and the extent of this effect is regulated to a certain amount by the proportion of alloying elements. Grain size does not seem to affect the transition temperature but may either narrow or widen the range in which the material transforms. Fine grained aggregates may transform much more readily than the larger crystalline material, and consequently the phase change will be quicker. This will have a tendency to narrow and sharpen the allotropic change while the large grains will act in the opposite manner and will lessen the intensification of transformation shortness.

When iron and steel are tested in the vicinity of 200 deg. C. a change in some of the physical properties of the material is noted. This

change does not always seem to be consistent but varies so that the exact cause of it can be only theorized. The following investigators observed changes in the physical properties of iron and steel in the vicinity of 200 deg. C.

Thompson and Whitehead showed that the electrical resistivity and thermoelectric power of iron and steel changed at this temperature.[16] Robins detected a variation in the physical properties of the material at 200 deg. C.[17] Gaffey and Thompson indicated the existence of this point also by means of electrical resistivity and by deviations in the elastic limit.[18] Tapell[19] determined this point of brittleness by fatigue, while Deardon[20] revealed that the specific heat changed at this temperature. Lea[21] proved that the elastic modulus of Armco iron varied at 196 deg. C., and finally, Cuthbertson summarized the above work and showed that a change occurred at 195 deg. C. by means of creep and fatigue tests.[22]

Torsional results of this and previous investigations further indicate that a change occurs at this particular temperature range. This change is more marked in the higher carbon steels than it seems to appear in the lower, and it also seems to appear more intense in the larger grained material, which has a coarser and larger carbide particle, than in the fine grain aggregate. The physical properties, at this particular temperature range, seem to possess peculiar characteristics as it sometimes exhibits marked ductility, in one type of heat treated steels, and brittleness in other types of heat treated steels.

The theory advanced here to account for the various changes noted is suggested by the curve in Fig. 13, first shown by Rosenhain and Humfrey[23] and later by Lee[24]. They obtained changes in the physical properties of iron and steel at the A_1, A_2 and A_3 points. The variations at A_3 and A_1 may be attributed to transformation, or transformation shortness, while the change at A_2 may be accounted for by two theories: (1) the loss of magnetism on heating, and (2) loss of magnetism plus a transformation of alpha to beta or gamma iron.

Regardless of theory, it is definitely known that iron loses most of its magnetism at this particular temperature. It is not certain whether or not this is the direct cause of the variation in the physical properties at the A_2 point, but it is very singular that at approximately 200 deg. C. another loss of magnetism occurs and a change in the physical properties of the material takes place. Honda has established firmly the fact that cementite loses its magnetism at about 215 to 220 deg. C. on heating, and it may be perfectly possible that as the result of cold work deformation this temperature is slightly lowered. If this is so, and Lee's diagram (Fig. 13) is correct, then in order to complete this diagram it should resemble Fig. 14.

This diagram (Fig. 14) shows the A_4, A_3, A_2 A_1 and A_0 points in iron and steel and appears complete, including the transition of delta to gamma iron (A_4) at about 1405 deg. C. According to the theory of transformation shortness, a range of brittleness should exist when delta iron transforms to gamma.

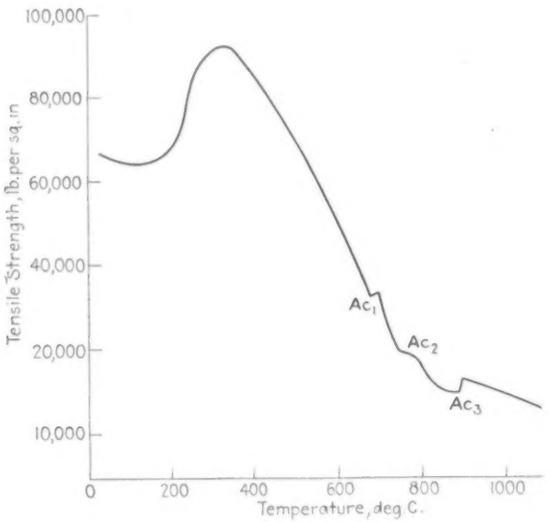


FIG. 13—This curve was used by Lee to demonstrate his theories regarding the nature of the changes in the physical properties of steels.

[16] F. C. Thompson and E. Whitehead, Proc. Royal Soc., Vol. 102, 1923.
[17] F. Robin, Iron and Steel Inst., Carnegie Mem., Vol. 2, 1910.
[18] A. Gaffey and F. C. Thompson, Jour. Iron and Steel Inst., Vol. 1, 1923.
[19] H. S. Tapell, Jour. Iron and Steel Inst., Vol. 1, 1928.
[20] W. H. Deardon, Jour. Iron and Steel Inst., Vol. 17, 1928.
[21] F. C. Lea, Proc. Inst. Mech. Eng., Vol. II, 1932.
[22] S. W. Cuthbertson, Jour. Iron and Steel Inst., Vol. II, 1932.
[23] W. Rosenhain and Humfrey, Jour. Iron and Steel Inst., Vol. 1, 1913.
[24] D. C. Lee, Doctorate's Thesis, Harvard University, 1924.

The explanation of the various ranges of brittleness in the above figure can be summarized briefly as follows: The A_4 by the transformation of gamma to delta iron; the A_3 by the transformation of alpha to gamma or beta to gamma iron; the A_2 by (1) transformation of alpha to beta, causing a loss of magnetism (on heating) or (2) loss of magnetism; the A_1 by the transformation of alpha to either beta or gamma iron; the A_0 by the loss of magnetism in cementite with a possible theoretical change of lattice.

The theory of brittleness at A_0 may be supported by the following facts:

(1) The loss of magnetism in cementite at 215 deg. C., on heating.

(2) Changes in the thermal, electrical and physical properties of iron and steel in the vicinity of 200 deg. C.

(3) The intensity of brittleness increases with the carbon content and size of the carbides.

(4) Rosenhain's type of curve (Fig. 13) shows a change in the physical properties of iron and steel, when iron loses its magnetism at the A_2 point which is very similar to the A_0.

The following results are presented to further illustrate some points of the above discussions and at the same time point out some of the characteristics and physical properties of a few steels at elevated temperatures. The results obtained in torsion at Harvard University since 1922, under the supervision of Professor Sauveur, fill many volumes and, therefore, cannot be discussed here, although an attempt is made to include as many variations of steels as possible in order to prove the theme of this dissertation.

[25] R. W. E. Leiter, Doctorate's Thesis, Harvard University, 1930.

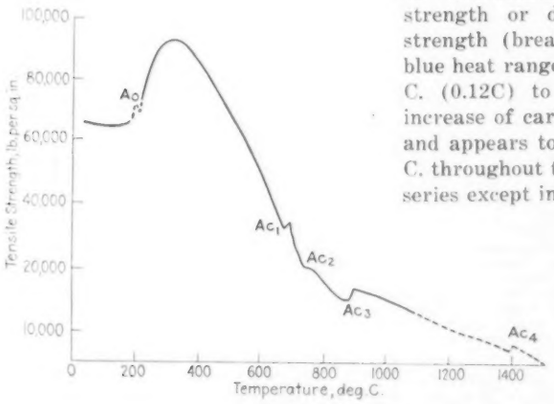


FIG. 14—An extension of Lee's diagram (see Fig. 13); these data serve to explain the various ranges of brittleness in steel.

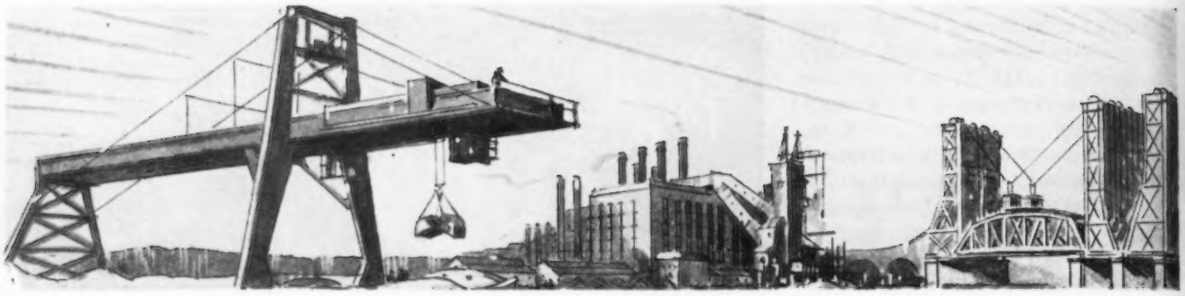
The first complete series of steels tested in torsion were by Dr. Leiter[25] in 1928, although Dr. Lee[24] determined the thermal critical points and the blue heat range in iron and steel as early as 1922. Some of the results obtained by Dr. Leiter are shown in Tables III and IV. These data were secured by means of hand loading described last week in THE IRON AGE.

These tables illustrate the trend of the blue range and show the importance of arriving at the right criterion for determining this type of brittleness, whether it be strength or ductility. If it be strength (breaking load) then the blue heat range rises from 275 deg. C. (0.12C) to 300 deg., with the increase of carbon (0.38 per cent), and appears to remain at 325 deg. C. throughout the remainder of the series except in the hyper-eutectoid steel (1.23C) where it drops to 300 deg. C. The ductility (angle of twist in revolutions) acts in the opposite direction. The blue heat range drops from 325 deg. C. (0.12C) to 275 deg. in the eutectoid (0.82C) and then remains constant with the exception of the hyper-eutectoid (1.02C), where it is higher (325 deg. C.)

Therefore the importance of determining a criterion for blue brittleness cannot be emphasized too strongly, as the temperature varies as much as 50 deg. C. between brittleness, determined by strength (breaking weight), and ductility (angle of twist). This criterion of brittleness acts in the opposite direction with the increase of carbon content. These results are in agreement with Dr. Lee's work, in which he determines the above range by means of tensile testing and hardness readings.

A further summary of Table III shows that the breaking weight of the steels is at a maximum at —180 deg. C., and decreases rapidly until a minimum is reached at 100 deg. in the hypo and eutectoid steels, and at 200 deg. C. in the hyper-eutectoid steels. The breaking strength increases with the carbon content until it is at a maximum in the slightly hyper-eutectoid steel (1.02C) and declines with further increase of carbon.

EDITOR'S NOTE: *In a forthcoming issue Dr. Shapiro will continue this discussion of torsion results. This series of articles will then be ended with a summation of new data and a survey of stress-strain relationships.*



Plant Expansion and Equipment Buying

Industrial Demand for Machine Tools Improves—Railroads Still a Factor

HEAVY industry has entered the list of prospective customers for the machine tool industry during the last week. The Youngstown Sheet & Tube Co. is taking bids immediately on 15 units for its Brier Hill works machine shop at Youngstown, including lathes, planers, milling machines, shapers and standard tools. The Westinghouse Electric & Mfg. Co., East Pittsburgh, has also issued a fair-sized list. Other miscellaneous orders appear likely to be placed in the near future, which will do much to offset the current lack of interest of the automotive industry.

Railroad programs for 1935 are coming to light from time to time. The Missouri Pacific and subsidiaries will spend more than $200,000 for tools during the year.

The market for heavy machinery and equipment is active. The Bethlehem Steel Co. is reported to have placed the order for its new continuous strip mill at Lackawanna, N. Y., with a Pittsburgh builder, and a large Pittsburgh steel company is also understood to have placed heavy orders for equipment.

◀ NORTH ATLANTIC ▶

Union Bag & Paper Corpn., Woolworth Building, New York, is arranging with City Commission, Jacksonville, Fla., and Board of Duval County Commissioners, same place, for lease of about 1200 acres in Eastport district, for new pulp and paper mill, with adjoining paper-converting plant for bag and container production. Project will include power house, machine shop and other mechanical departments, storage and distributing buildings. Cost over $3,000,000 with equipment.

National Distillers Products Corpn., 120 Broadway, New York, has acquired plant and business of W. A. Gaines & Co., Frankfort, Ky., distillers. Plans are under way for modernization and improvements, including installation of new equipment. Company has also purchased Hellman Co., St. Louis, liquor distributor for Gaines company, and will expand storage and distribution facilities at last noted place.

Treiber Electric Sign Corpn., Albany, N. Y., has been organized by William Snyder, 7 Morton Avenue, and Solomon M. Gilens, 139 Dana Avenue, to manufacture electric signs and displays.

Signal Supply Officer, Army Base, Brooklyn, asks bids until March 4 for 24,500 ft. insulated telephone cable and seven reels (Circular 84).

Board of Education, Tupper Lake, N. Y., plans manual training department in new multi-story high and grade school, for which bids will be asked soon on general contract. Fund of $300,000 has been arranged. R. R. Graham, Middletown, N. Y., is architect; Elwyn E. Seelye & Co., 101 Park Avenue, New York, are consulting engineers.

National Broadcasting Co., 30 Rockfeller Plaza, New York, plans radio broadcasting plant at Hollywood, Cal., including experimental station for television facilities. Cost over $200,000 with equipment.

American Toy Works, 7 Chatham Square, New York, manufacturer of mechanical and other toys, has leased 20,000 sq. ft. in building at 41 East Eleventh Street for new plant, and will remove to new location and increase capacity.

National Lead Co., 111 Broadway, New York, has filed plans for new three-story plant at 157 John Street, Brooklyn, to be operated in conjunction with white lead works at 135 Marshall Street, Brooklyn. Cost over $50,000 with equipment. William Higginson & Son, 101 Park Avenue, New York, are architects.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until March 5 for six motor-driven air compressors and spare parts for Brooklyn and Philadelphia navy yards (Schedule 4323); until March 8, metal lockers for Brooklyn, Philadelphia and Charleston yards.

Pullman Co., 79 East Adams Street, Chicago, has acquired property, 150 x 200 ft., on Forty-eighth Avenue, Long Island City, for two-story and basement mechanical laundry plant, including steam power house. Cost over $85,000 with machinery.

American Platinum Works, 231 New Jersey Railroad Avenue, Newark, N. J., has let general contract to Edward M. Waldron, Inc., 40 Park Place, for one and two-story addition. Cost over $30,000 with equipment. Epple & Kahrs, 17 Washington Street, are architects.

R. Hutchinson, Inc., Perth Amboy, N. J., has been organized by R. Hutchinson, care of George J. Miller, 176 Smith Street, representative, to manufacture brass, bronze and other metal castings.

Wilson-Jones Co., South Elmora Avenue, Elizabeth, N. J., manufacturer of loose-leaf paper products and kindred commercial paper goods, plans addition to paper converting plant, for which it is proposed to award general contract in March. Cost over $150,000. Main offices are at Chicago.

Pocono Rubber Co., East State Street, Trenton, N. J., manufacturer of general rubber goods, plans rebuilding part of mill recently destroyed by fire. Loss about $50,000 with equipment.

American Type Founders Co., 300 Communipaw Avenue, Jersey City, N. J., will merge local plant, including foundry, finishing shop and other departments with its Kelly Press Division, 200 Elmora Avenue, Elizabeth, N. J., manufacturer of printing presses and parts, at last noted address, where expansion will be carried out.

Bureau of Yards and Docks, Navy Department, Washington, has let general contract to Irwin & Leighton, 1505 Race Street, Philadelphia, for shop additions at Aircraft Factory, Navy Yard, Philadelphia, including aircraft engine plant for parts production and assembling, testing works, shop hangar and other units, at $893,000. Fund of about $2,700,000 has been authorized for expansion at factory, including tools and equipment.

Arco Welding & Machine Works, Inc., 37 James Street, Jersey City, N. J., recently completed an addition, 40 x 90 ft., to its plant. Company is engaged in welding, machining and general steel plate construction.

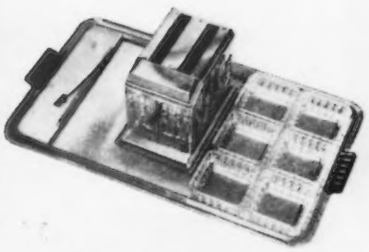
◀ NEW ENGLAND ▶

Boston Consolidated Gas Co., 250 Stuart Street, Boston, plans new tar storage and distribution terminal at Everett, Mass., including steel tanks and other equipment. Cost about $35,000.

New Process Wire Co., Bridgeport, Conn., has been organized by Howard A. Smith, 180 Penfield Road, Fairfield, Conn., and William J. Buckley, 886 Main Street, Bridgeport, to manufacture steel wire products.

Arnold Print Works, Inc., 87 Marshall Street, North Adams, Mass., has authorized erection of new steam power plant for service at textile dye and print works, for which building contract has been let to Berlin Construction Co., Berlin, Conn. Cost over $150,000 with equipment. Westcott & Mapes, Inc., 139 Orange Street, New Haven, Conn., is consulting engineer.

Board of Selectmen, Westwood, Mass., plans manual training department in new



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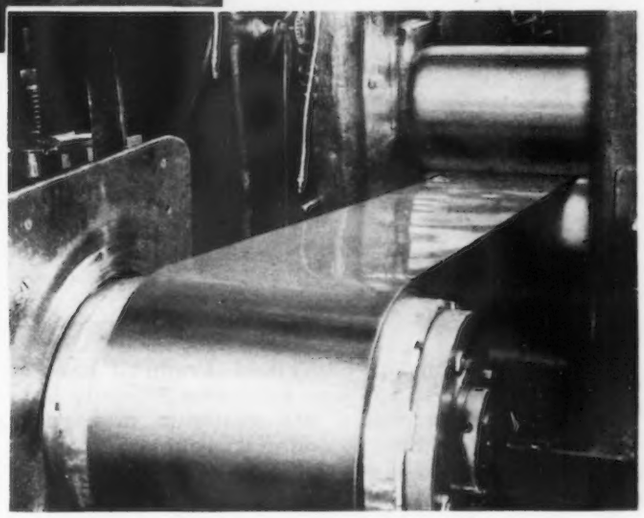

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two-story high school. Cost over $150,000. H. E. Mason, 15 Prospect Street, Leominster, Mass., is architect. W. H. Spokesfield is chairman of building committee in charge.

Ezykut Tool Corpn., Northampton, Mass., has been organized by Frank Edward Dow, 4 West Street, and associates, to manufacture cutting tools and other mechanical equipment.

BUFFALO DISTRICT

Tide Water Oil Co., 17 Battery Place, New York, has plans for new bulk oil storage and distributing plant at Syracuse, N. Y., with steel tanks, pumping station and other facilities. Cost close to $60,000 with equipment.

Board of Education, District No. 9, Cheektowaga, N. Y., plans manual training department in new two-story and basement junior and senior high school, for which bids will be asked on general contract in spring. Cost about $225,000. Financing has been arranged. Joseph E. Fronczak, 1176 Walden Avenue, is architect.

Austin Electric Co., Inc., Auburn, N. Y., has been organized by Lewis A. Austin, 218 South Seward Avenue, and associates, to manufacture electrical specialties, tools, etc.

Canadian Boat Industries, Ltd., 372 Bay Street, Toronto, plans one-story addition, 75 x 125 ft., to boat building and repair plant, with foundations for second story later, including new marine railway facilities, at Whitby, Ont. Cost about $65,000 with equipment.

WESTERN PA. DIST.

Kendall Refining Co., Bradford, Pa., manufacturer of lubricating oils, etc., has leased 13,000 sq. ft. in building at 35 Fraser Avenue, Toronto, Ont., for branch plant. Company is organizing Kendall Refining Co. of Canada, Ltd., to operate new works. E. J. Kenney will be in charge.

City Council, Warren, Pa., is considering new municipal electric light and power plant, using Diesel engine-generating units. Cost about $200,000 with equipment. Hadlow & Elwell, 5005 Euclid Avenue, Cleveland, are consulting engineers.

Board of Allegheny County Commissioners, Court House, Pittsburgh, Robert G. Woodside, County controller, asks bids on general contract until March 5 for new industrial arts building at Allegheny County Industrial and Training School for Boys, Marshall Township.

SOUTH ATLANTIC

City Council, High Point, N. C., plans new municipal electrical distribution system. Cost about $300,000 with substations and other facilities. Financing will be arranged soon.

Carl S. Swisher & Son, Inc., East Sixteenth Street, Jacksonville, Fla., manufacturer of tobacco products, has let general contract for three-story and basement addition, 116 x 125 ft. Cost about $100,000 with conveying, loading and other mechanical-handling equipment.

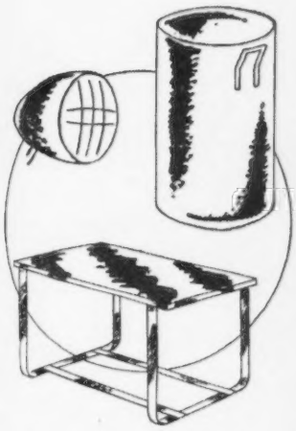
Southern Public Utilities Co., High Point, N. C., has plans for one-story machine shop. An automobile service and garage building will also be built. Cost close to $22,000 with equipment.

W. W. Ward, 312 Gainer Street, Dublin, Ga., is at head of project to erect a mining plant on tract of aluminum ore deposits in Laurens County, and plans purchase of equipment for ore extraction, material-handling and other service.

OHIO AND INDIANA

Gummed Products Co., Troy, Ohio, manufacturer of gummed paper products, has let general contract to Gillmore-Carmichael-Olson Co., Euclid Building, Cleveland, for one-story addition to paper converting plant, totaling 50,000 sq. ft. floor space, and for one-story power house. Cost over $200,000 with machinery. John H. Deeken, Times-Star Building, Cincinnati, is architect.

Franklin Brewery Co., River and Sandusky Streets, Columbus, Ohio, has let



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general contract to Trapp-Carroll Co., 255 East Broad Street, for two additions, three-stories, 57 x 65 ft., and one-story, 36 x 41 ft., for storage and distribution, and general production. Cost close to $60,000 with equipment.

St. Clair Sheet Metal & Roofing Co., Cleveland, has been organized by Henry A. Lavine, Cleveland, care of Fred S. Day, Leader Building, representative, and associates, to manufacture sheet metal products.

Material Division, Air Corps, Wright Field, Dayton, Ohio, asks bids until March 4 for 166 motor-generators (Circular 497); until March 5, gun control switch assemblies and solenoid assemblies (Circular 498).

Department of Public Service, City Hall, Cincinnati, J. E. Root, director, will soon take bids for extensions and improvements in municipal incinerator plant on Bates Avenue, including new 200-ton incinerator unit, 250-hp. boiler with accessories, stokers, conveyors, loaders and other equipment. Cost about $125,000. Fosdick & Hilmer, Union Trust Building, are consulting engineers.

Water Department, City Hall, Connersville, Ind., plans electrification of waterworks station, including installation of two or more Diesel engine units, five pumping units, elevated tank and tower, and other equipment. Cost about $100,000 with machinery. John W. Moore & Son, Indiana Pythian Building, Indianapolis, are consulting engineers.

Board of State Highway Commissioners, State House Annex, Indianapolis, asks bids on general contract until March 5 for new one and two-story equipment storage, service and oil storage and distributing building, 52 x 122 ft., at Winamac, Ind., with motor truck garage and service unit.

◀ WASHINGTON DIST. ▶

Allegany County Board of Education, Cumberland, Md., plans manual training department in new three-story junior and senior high school, for which bids are being asked on general contract until March 15. Cost about $700,000. Robert Holt Hitchins, Cumberland, is architect.

Chief of Ordnance, United States Army, Washington, asks bids until March 12 for one universal milling machine, two engine lathes, two precision lathes, and one portable spray-painting outfit (Circular 25); until March 13, one automatic screw machine, one gear shaper, one woodworking lathe, one double surfacer, two bench lathes, one portable pipe threader, one drill grinder, one jig borer, one semi-automatic straightening press, one centering machine and one air compressor (Circular 26), five horizontal milling machines, one turret lathe, two hollow chisel mortisers, one gear grinding machine, one cylindrical grinder, one motor-driven metal plate shear (Circular 27).

Town Council, Christiansburg, Va., plans new municipal electric light and power plant. Financing will soon be arranged for $250,000, including distribution lines.

Office of Architect of the Capitol, Washington, David Lynn, architect, asks bids until March 12 for steel lockers, safes, cabinets, shelving, cases, tables, etc., for Supreme Court Building.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until March 5 for 30 motor-driven portable pumps and accessories for Norfolk, Philadelphia, Boston, Mare Island and other navy yards (Schedule 4309); until March 8, quantity of rough machined steel forgings for Eastern and Western navy yards (Schedule 4321).

◀ SOUTHWEST ▶

United States Engineer Office, Custom House, St. Louis, asks bids until April 1 for dam 26 in Mississippi River, Alton, Ill., including electric-operated roller gates, tainter gates, four-roller gate operating house, central control station and other mechanical equipment.

Oil Well Supply Co., Dallas, Tex., has let general contract to W. A. Shank Construction Co., Kilgore, Tex., for one-story factory branch, storage and distributing plant, 36 x 60 ft., at Hutchinson, Kan.

Peacock Special Machine & Drilling Co., Paola, Kan., manufacturer of machinery and parts, plans extensions and improvements, including additional equipment. Cost about $25,000 with machinery.

B. & B. Combustion Equipment Co., St. Louis, has been organized by Otis O. Barr and Eugene S. Bremmerman, 4452 Duncan Street, to manufacture furnace and combustion equipment.

Board of Education, Duncan, Okla., plans manual training department in new multi-story high school and junior college, for which general contract will be let in about 30 days. Cost about $125,000. J. B. White, Ardmore, Okla., is architect.

City Council, Wichita Falls, Tex., has authorized new municipal electric light and power plant, with distribution system. Cost $2,220,000 with equipment. Financing will be arranged soon.

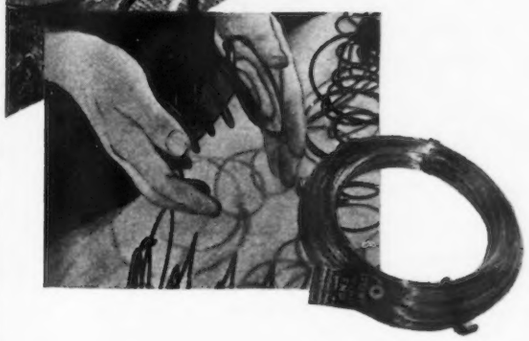
Polk Co., Fort Worth, Tex., recently organized by Samuel W. Polk, Fort Worth, and associates, to manufacture oil well equipment and parts, oil refinery machinery, etc., has leased property at 805 Bryan Avenue for new plant

◀ MIDDLE WEST ▶

White Cap Co., 1806 North Central Avenue, Chicago, manufacturer of metal caps for jars and containers, and kindred metal goods, has let general contract to Campbell, Lowrie & Lautermilch Corpn., 400 West Madison Street, for two-story addition, 100 x 120 ft. Cost close to $75,000 with equipment. R. F. Dressler, 32 West Randolph Street, is architect.

Commercial Metal Products Co., Chicago, has been organized by A. S. and Samuel J. Zagel, Jr., to manufacture metal goods. Company will take over Com-

he dictates Wire Specifications



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Wickwire Spencer manufactures High and Low Carbon Wires—in various tempers, grades and finishes—for your specific purpose. Hard-Drawn, soft or annealed Basic or Bessemer Wires—Hard-Drawn annealed, or oil-tempered Spring Wire, Chrome Vanadium Spring Wire—Valve Spring—Music—Clip—Pin—Hairpin—Hook and Eye—Broom—Stapling—Bookbinding—Machinery Spring Wire—Reed Wire—Clock—Pinion—Needle-Bar—Screw Stock—Armature Binding—Brush—Card—Florist—Mattress—Shaped—Rope—Welding. Flat Wire and Strip Steel, High or Low Carbon—Hard, annealed or tempered—Clock Spring Steel—Corrosion and Heat Resisting Wires. Consult the Wissco technical man on your wire problems, however large or small.

mercial Metal Spinning & Products Co., 2014 West Wabansia Avenue.

Armour & Co., Chicago, meat packers, have plans for new abattoir and packing plant at Forty-third and Loomis Streets, 160 x 238 ft. Cost over $450,000 with equipment.

City Council, Boone, Iowa, plans early call for bids for new municipal electric light and power plant, with distribution lines. Cost close to $900,000. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

Champlin Refining Co., 2201 Nineteenth Street, Denver, with headquarters at Enid, Okla., has let general contract to A. A. Jones, 1471 South Franklin Street, Denver, for new one-story oil refinery, 50 x 100 ft.

Emeralite Surfacing Products Co., Ely, Minn., manufacturer of roofing products, plans rebuilding part of plant recently destroyed by fire, including raw material grinding mill and other units. Loss about $65,000 with equipment.

Blatchford Corpn., Ridgeway Avenue, Aurora, Ill., manufacturer of railway equipment and supplies, has approved plans for extensions and improvements, including new furnace equipment, loading and other mechanical-handling equipment, etc. R. B. Berg is plant superintendent.

MICHIGAN DISTRICT

Michigan By-Products Coke Co., Grand Haven, Mich., care of Leo C. Lillie, Grand Haven, president, recently organized, plans new coke and by-products plant adjoining property of Grand Haven Terminals Co., with which new company is affiliated. Plant will include power house, machine shop and other structures, with battery of coke ovens, and will have initial capacity of about 300 tons daily, in addition to by-products. Cost about $1,500,000 with equipment.

Gormley Malt Co., Holley, Mich., has plans for new three and four-story plant, including main unit and storage and distributing divisions. Cost close to $50,000 with equipment. G. Bachman, Flint, Mich., is architect.

Ford Motor Co., Dearborn, Mich., has let general contract to Cooper-Little Co., Maccabees Building, Detroit, for one-story addition to branch plant at Ypsilanti, Mich., and improvements in present works. Cost over $50,000 with equipment. Albert Kahn, Inc., Detroit, is architect.

Dunham-Moore Mfg. Co., Carleton, Mich., has been organized by Henry Nau, Jr., 324 South Laurel Avenue, Royal Oak, Mich., and associates to manufacture machinery and parts.

Macklin Co., Jackson, Mich., manufacturer of abrasive products, grinding wheels, etc., has approved plans for one-story addition, 40 x 100 ft.

General Gear Co., Detroit, manufacturer of small spur, spiral and worm gears of steel, brass and other materials, is operating a plant at 2930 East Canfield Avenue. F. A. Bernstein is general manager.

SOUTH CENTRAL

Kennebec Distillery Co., Frankfort, Ky., has plans for new works, consisting of main distillery units, grain house, storage and distributing buildings, power house, machine and miscellaneous structures. Cost close to $100,000 with equipment. Carl J. Kiefer, Schmidt Building, Cincinnati, is consulting engineer.

Board of Trustees, Alabama Boys' Industrial School, Birmingham, will soon take bids for new steam power house for central heating service. Cost over $45,000 with equipment, pipe lines, etc. Warren, Knight & Davis, Birmingham, are architects.

Water Department, Covington, Ky., plans extensions in Devou Park, including new steel tank and tower, and other equipment. Cost about $45,000. Plans are also under consideration for new municipal filtration plant, to cost about $750,000 with pumping machinery, filter equipment, pipe lines, etc. Financing will be arranged soon.

General Distillers Corpn., Louisville, care of Walter C. Wagner, Breslin Building, architect, has plans for new storage and distributing plant. Cost over $60,000 with equipment.

Town Council, Eupora, Miss., asks bids until March 5 for pumping machinery and accessories for municipal water system.

Southern States Iron Roofing Co., Birmingham, has leased building at 521-29 North Twenty-eighth Street for plant.

PACIFIC COAST

Board of Directors, Imperial Irrigation District, El Centro, Cal., Evan T. Hewes, president, plans hydroelectric power project on All-American Irrigation Canal, comprising five such generating stations, with transmission and distributing lines, substations and switching stations for service in Imperial and Coachella valleys. Cost about $12,000,000, of which $6,600,000 will be used for generating stations, $3,600,000 for transmission and distribution systems, and remainder for standby steam-operated power plant at Brawley. Work on last noted station has begun. It is proposed to arrange financing soon.

Associated Oil Co., 79 New Montgomery Street, San Francisco, is arranging fund of $8,900,000 for new construction and improvements, of which about $6,300,000 will be used for development of oil properties in Ventura and San Joaquin Valley districts, including oil-drilling and other machinery, tank farm expansion, etc.; and approximately $1,175,000 for extensions and improvements in oil refineries in State, with installation of new equipment. About $530,000 will be used for transportation facilities, including new steel pipe lines, tank trucks, etc. Company is a subsidiary of Tide Water Associated Oil Co., New York.

City Council, Bountiful, Utah, has been authorized at special election to arrange bond issue of $106,000, fund to be used for new municipal electric light and power plant and distribution system. Bids will be called soon.

Sacramento School District, Sacramento, Cal., plans vocational training department in new multi-story high school in southeastern part of city. Cost about $500,000. Starks & Flanders, Forum Building, are architects.

Bozeman Canning Co., North D Street, Ellensburg, Wash., food canner and packer, has authorized addition to plant to double present capacity. Cost over $150,000 with equipment.

FOREIGN

National Coke & Oil Co., Ltd., Trafford Park, Manchester, England, has acquired about 5 acre tract for new plant for extraction of oil from coal. A by-products works will be built for production of smokeless fuel. Project will include power house, machine shop and other mechanical departments. Cost over $1,500,000 with equipment.

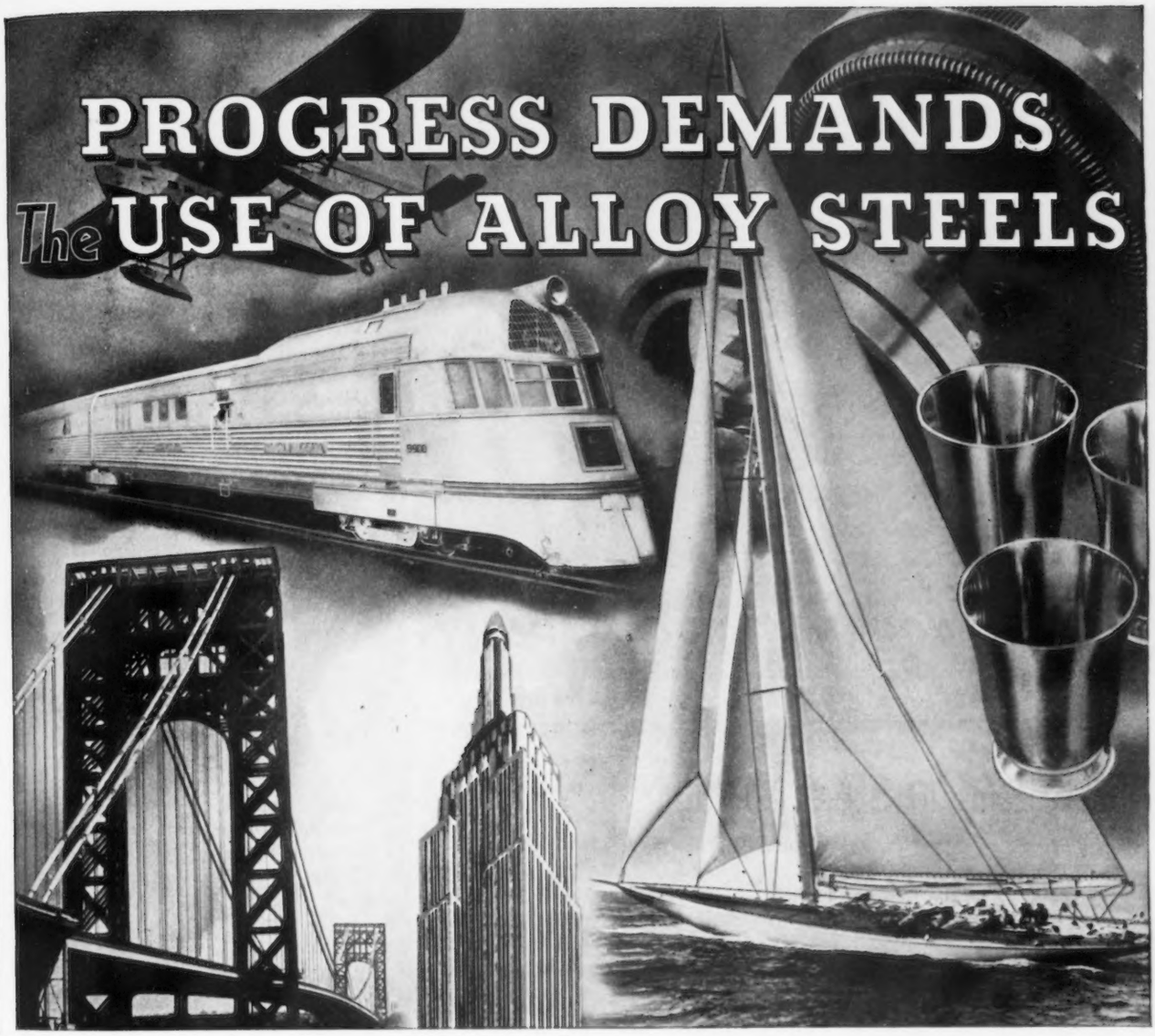
Australian Paper Manufacturers, Ltd., Melbourne, Australia, plans new pulp and paper mill on site now being selected in southern Australia, including storage and distributing units, machine shop, power house and other structures. Cost close to $1,000,000 with machinery.

Ministry of War, Chinese Nanking Government, Canton, China, has approved plans for air base at Loyang, Honan Province, including hangars, aircraft construction and repair shops, and other units, with facilities for aviation instruction. Cost over $500,000 with equipment. Three similar air bases will be constructed on other sites to be selected soon, each to cost close to like sum, also a number of secondary bases to be located within airplane cruising radius of major stations.

Correction

IN THE IRON AGE, Feb. 21, page 41, it was stated that the stainless steel required for 15 single unit cars to be built in Italy under fabricating patents of the Edward G. Budd Mfg. Co., Philadelphia, had been ordered from the Allegheny Steel Co., Brackenridge, Pa. Later advices indicate that the material for this work has not been placed.

Trustees of Follansbee Brothers Co., Pittsburgh, were authorized to borrow $500,000 against trustees' certificates to permit fuller operation of the company's Toronto, Ohio, mill, in a Federal Court order issued last week. The order empowered the trustees to issue certificates in multiples of $1,000, to mature at their discretion, but not later than next Dec. 31. Interest was fixed at 5 per cent, payable at maturity.



RAILROAD men are redesigning rolling equipment. By the use of alloy steels they are increasing speed and safety of operation while decreasing costly dead weight. Car superstructure, such as side frames and sheets, are fabricated from stainless steel. Locomotive beds and car trucks are made of low chromium alloy steel.

Such improvements are not exclusive to the railroad industry. Corrosion problems in chemical plants and oil refineries have been minimized by the use of high chromium steels. The use of stainless steel equipment improves the taste and quality of many foods and beverages. Buildings reflect its spotless beauty. Alloy steels can be made to meet the most exacting demands.

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Problems in Steel Melting

(CONTINUED FROM PAGE 33)

of oxidation at the roof-gas interface at times when it may be highly desirable to have strictly reducing conditions at the gas-slag interface. The answer to this problem may be a refractory such as has been experimentally used, but is not available commercially. These experimental refractories have not yet made headway against the cheap, very useful silica brick.

The commercial practice most favored in this country in building a melting hearth for basic steelmaking is to bind in some fashion magnesium oxide, as pure as the operation will tolerate, and on this carry a working face as refractory as the operation will permit. This means the quality of the refractory can be varied with the ability to work it into the steel structure. Pure, or nearly pure, magnesium oxide in the form of electric sintered periclase is used in electric furnace bottoms. The bond in electric furnaces may be water glass sufficient to make the particles adhere cold. The mixture is rammed into place and a monolithic bottom results. The working face is prepared from materials which bond at more reasonable temperatures.

The above indicates an immense desirability of magnesium oxide as a material for steel melting. This choice is largely influenced by two important properties of this material. It is pyroplastic and will absorb more than half its weight of iron as FeO before the fusibility is lowered to such a point that it is not commercially usable. Such a permanent base in service is soft, but not liquid, and it resists thermal shocks and erosion in a remarkable way. Since it does not react commercially with the molten metal, a chemical change in service need not be anticipated. Its difficulty is that when pure it is too refractory, and its very nature makes it difficult to alter uniformly. But in Austrian magnesite nature has provided an impure form which is very useful in the lower temperature ranges encountered in basic open-hearths. The calcined product of mixed magnesium and iron carbonates provides a material which can be bonded solidly at usual working temperatures.

The procedure is to mix with the magnesite an amount of open-hearth slag. This slag, which carries lime and silica with ferrous iron, combines with the outer layers of the magnesite. The cubical particles of magnesite are made somewhat spherical in the operation due to the solubility of the corners, and the resulting sections show cubical cleavage lines crossing, which are essentially circular plates. The iron oxide dissolving slowly into the magnesite grain gives an edge stain that increases if the surrounding medium can supply the required iron oxide. A continued supply of oxide of iron results in a lowering of fusibility, and the outer layers of the grain melt and join the slag. The failure is as slow as the surrounding conditions dictate, and thus no erosion may be expected when the oxide of iron or other fluxing material is limited.

In making very low metalloid content materials, such as open-hearth irons, a melter must anticipate that the bottom fluxing will be increased. The penetration rate is very slow, therefore, and only the outer layers are damaged. Even after extensive damage due to making highly oxidized steels, it is quite safe to reface with fresh magnesite, burn in to establish a bond and proceed with melting operation. Where the carbon content of the steel does not fall below about 0.30 in the furnace, the damage to the bottom by oxidation products is not enough to be a factor. In such melting practice the reverse is also true, that is, the slags are so refractory that they serve to add to the bottom.

It is interesting to examine a section of a bottom in which manganese oxide has replaced, as a bottom material, magnesium oxide by the process of building up. The same cubical cleavage lines are present and show across circular areas of the interstitial mass. This is a silicate very similar in character to the corresponding lime silicate which bonds a basic open-hearth bottom. If manganese were sufficiently cheap it might serve as a bottom material for certain high manganese steels, but such a bottom would react freely with the molten metal.

It would be highly desirable if we could have for our furnace bottoms an economical material which would remain immune to the widely varying conditions encountered in service. If such a bottom material were available we could eliminate one variable from the now

3 GOOD REASONS

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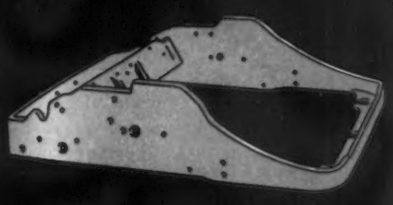

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too-complicated system of slag, gas, metal and bottom. There is no indication of this ideal bottom at the present time.

The usual basic furnace is charged with a mixture of ferrous materials, basic refractories, and alloys. The order of working to repair the exposed face of the working bottom consists, first, of an application of varying amounts of magnesite, clinkered dolomitic refractories and dolomite, preferably double burnt, although it is often in the raw form. On this is charged lime, either as stone or burnt lime. The ferrous materials are next charged and the whole is then melted down.

In the early stages of melting, the only liquid portions are the oxidation products of the metal itself combined with a small amount of the hearth material which fluxes with this highly corrosive slag. The physical appearances of the slag has been used for some years, both here and abroad, to guide the melter in handling the furnace. To develop more information concerning the factors involved, some hundreds of slag samples have been sectioned for study. Additional studies using reflected light are under way. Reflected light, while simpler in specimen preparation, does not offer the startling contrasts presented when color is permitted to aid but, due to the very large areas easily prepared, will probably be the most useful method in the longer time studies.

Numerous studies of slag samples have shown that melters are not working with homogeneous liquid phases. This is apparent, for the lumps of uncombined material can both be seen and felt. Any method of sampling will produce unalterable evidence of partial equilibrium in the way of partially combined products. Thus this subject can best be approached on the basis of personal observation of the facts, for which the explanation lies in the future.

Some very characteristic slag structures are encountered in any study. In addition, similar structures are secured from such widely varying operation that it is reasonable to assume that these structures associate with some very definite conditions. The laws governing these occurrences are either still not known or at least not widely published.

The acid open-hearth slag is essentially the product of oxidation of the metal itself, and in basic melting it is found that the melt-down slags have nearly the same character as acid slags. They are nearly clear, usually having a greenish cast on the splintered edges. They are acicular and apparently of but two phases when chilled. They are high enough in basic components to be out of the acid class, and they are very inactive slags due to their high ability to dissolve iron oxide and render it inert.

The basic melt-down slag, which is nearly a single phase, gives way to a multiple-phase structure. In appearance it is usually a black slag carrying certain white particles. The rounded shapes are similar to those encountered when combination is taking place by solution of a material which has a very limited ability to absorb the dissolving medium. At present there is little definitely known of the character of the black, previously liquid areas. The white material corresponds to the lime silicate $2CaOSiO_2$, but what may be dissolved in it is still the subject of speculation. It is known from the unpublished work of Mr. A. T. Cape that phosphorus compounds dissolve in dicalcium silicates, causing it to become stable in cooling. The work of Bowen and associates shows that, at steel-working temperatures, it has a high solubility for lime iron compounds. It is of interest to study the very large floating lumps in a slag to theorize on the genesis of this form of lime silicate.

Lumps can be found floating in the liquid if early slags are sampled. These lumps may be so large that they weigh several pounds, and they are covered with a characteristic shell which in the section looks almost white, but has a blocky appearance. This shell is $2\ CaO\ SiO_2$, carrying with it an unknown amount of dissolved materials. As the examination progresses toward the center of the lump it can be noted that the white gives way to a honey yellow material which seems to fill the interstitial space of the $2\ CaO\ SiO_2$, and further in it is seen that the yellow darkens to a brown. The structure at higher magnification appears to be a series of veins of yellow into the white grains which are edged with brown. In rare cases in basic open-hearth work the brown is associated with a deep red material.

The floater lump of lime is in the process of decomposition and a probable explanation of this decomposition is of interest. The contact of the slag, which in the early stages is nearly the oxidation product of the metal itself, provides a large amount of very liquid silicates which soak the colder, partially or completely burnt lime.

Combination takes place at the very low temperatures of the early stages. The lime, having a very high affinity for silica, extracts from the molten silicates enough to form 2 CaO SiO_2, which is extremely infusible. It is a material with but a limited solubility for the other metallic oxides, and the result is the formation of fingers of 2 CaO SiO_2 surrounded by the combined iron manganese lime solution. As long as an excess of silicate is present this reaction can proceed with the commercial result of an increasingly infusible slag. When the silicate of this mixture is combined there remains an excess of metallic oxides and lime to form additional calcium ferrites. These are low melting point materials, not particularly stable, having a very active nature.

At this state it is well to discuss for a moment the lack of positive identification of the slag structures which are encountered. Practically none of the slag constituents occur naturally, and two reasons might be offered for this peculiar condition. Basic igneous materials are uncommon. In the whole of North America, it is estimated by Daly, that they comprise less than one-tenth of 1 per cent of the igneous rocks known. When to this fact is added the complication of sudden formation, such as is encountered in steel-melting practice, there are thus many reasons to believe that natural minerals corresponding to these slags will hardly be found. Confirming this is the fact that 2CaO SiO_2 occurs in one spot in the world, at Larne, Ireland, and even this natural product changes upon shock to another modification.

As the practical application of the study of these slag structures progresses, positive identification will probably be made. This is in the future, but is at present being worked upon in several laboratories. The study represents a major problem of melting control, and will best be cleared up by the mineralogists of our universities working with carefully made artificial mineral specimens.

The steel melter is face to face with the following problems: The bottoms combine with slag in the basic furnaces, and with the metal in the acid furnaces. So long as melters must work on unknown bottoms, many critical problems in melting equilibrium may be expected. What is very much needed is a pyroplastic material which is inert to slag and the metals melted within it.

The roof and wall material now in use is barely safe at present operating temperatures. Numerous studies and practical experience indicate that sulphur problems would be minimized if higher temperatures could be safely used. The open-hearth technician could find wide use for a construction material that is insensitive to heat shock, and capable of handling 3500 deg. F.

It is known that the working conditions being studied hover steadily around 3000 deg. F. But little is known of the relation of the mass (within the furnace), which is a liquid with an intermixture of solids, to the specimen which is investigated by chemical or other means of analysis remote from its natural environment. Thermal chemical mineralogical studies will clear up much of the lack of information that causes so much trouble. If it were possible to sample the slags with certainty and know that the results paralleled the heat or the action within the furnace, then studies of this nature would be far more satisfactory. Comparative results have indicated that most of the methods of sampling are satisfactory for the microscopic study of the insoluble phase.

There are very definite problems involved in sampling for chemical analysis. Whether the trend of the future will be toward physical mineralogical studies of quantitative and physical chemistry depends upon which method is best served by the samples obtained.

The many open-hearth operators, who are interested in the commercial aspects of melting control, have before them the problem of providing the facilities for the men who will work upon this and similar problems. It is known that in the generation preceding ours the thinking minds of steel metallurgy were focussed to a large degree upon the metallic portions of the system. This problem of the metal was in their day the more important aspect of the major problem. Likewise it is known that in repeated cases men proceeded part way on the slag control studies only to find the problems of the metal itself so far from solution that no basis of control was intelligent. It would be well to be reminded that Dr. Howe was originally interested in the slags as well as the metallic products.